The

Journal of Heredity

(Formerly the American Breeders' Magazine)

Vol. VI, No. 2 February, 1915

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The Journal of Heredity is published monthly by the American Genetic Association (formerly called the American Breeders' Association) for the benefit of its members. Fifty per cent. of the annual membership fee is specifically designated as payment for the Journal. Canadian members who desire to receive it should send 25 cents a year, in addition to their regular membership dues of $2, because of additional postage on the magazine; foreign members pay 50 cents extra for the same reason. Price of single copies, 25 cents.

Entered as second-class matter August 27, 1912, at the postoffice at Washington, D. C., under the act of August 24, 1912. Contents copyrighted 1914 by the American Genetic Association. Reproduction of articles or parts of articles permitted provided proper credit is given to author and to the Journal of Heredity (Organ of the American Genetic Association), Washington, D. C.

Date of issue of this number, January 25, 1915.

A VALUABLE TOBACCO MUTATION

During the last 15 years the study of mutations has been popular, and many have been discovered, but few of them have been of economic value. This giant form of Connecticut Cuban tobacco, which suddenly appeared in a field of the Windsor Tobacco Growers' Corporation, and elsewhere, promises to add a large amount to the annual value of the crop in the state. It is breeding true and constant. (Frontispiece.)

[See "Tobacco Mutations," p. 73.]

WAR AND BIOLOGY

Militarism Can Not Be Justified by Appeal to Evolution and Natural Selection—The "Struggle for Existence" Misunderstood—The Present Responsibility of the Rural People.[1]

L. H. Bailey, *Ithaca, N. Y.*

EVERY great crisis imposes special obligations on the people; and certain classes or groups of the people may be met with separate phases of the obligation. So it is said that certain very definite responsibilities now rest on the farmer because of the upset of conditions produced by the great war.

In times of great stress, when the accessories of life and the unessentials are stripped from us, we come back suddenly to the necessities and to the bare problems of maintenance. If any durable good is to come to us as a people from the carnage in the Old World, one of the gains will be a quickened appreciation of our dependence on the essentials of the earth, and an accelerated determination to return to them as to the mother that gave us birth, and to the things that were ordained to us in the beginning. Every experience that brings us back to the munificence of the earth and to a conscious dependence on it, brings us back necessarily to the farmer, and he is elevated in the essential plan of any enduring human society. When the armies shall have killed each other off, when the supplies shall have been exhausted, when the military organizations shall have tired of their vanities, when vengeance has been spent, and when society becomes ashamed of itself, then we shall begin all over again at a slow and laborious process of reconstruction; and we must begin on the earth.

In these days of popular education, and particularly in this country where there are no organic social strata, the farmer should gain in relative position in society after every upheaval or devastation. He must make good the fundamental supplies. And for this reason, the farmer needs to prepare himself very well, that he may be a stronger citizen and better able to take his place. This, it seems to me, is the great message that you teachers are now to take to your people.

IMPROVING THE CROPS.

Much is said about the necessity of producing more crops and products because of the war. This is always the farmer's obligation. If this international slaughter quickens this obligation, as I think it will, the gain will be good and it will be real. I hope it will stimulate us all to do our best. There is just now abroad amongst us a teaching to the effect that the farmer cannot afford to put much additional effort into his crop-producing; there may be much truth in it; but it is a weakening philosophy: it is the farmer's ethical responsibility to society to increase his production; and if he is not remunerated, we must see to it, we all of us, that society so regulates itself as to correct the situation. It is specially important that the man at the bottom and in the background put forth his best efforts.

I hope that this demoralization will make us more self-resourceful. I hope we shall have more appreciation of our position on the planet, more care of our natural resources, more determination to do things that will stand, more understanding of the things that are worth while on the earth that is given to our keeping.

We are onlookers on the greatest carnage and the most wretched destruc-

[1] Parts of an address delivered before the nineteenth annual meeting of the American Association of Farmers' Institute Workers, Washington, D. C., November, 1914; and elsewhere.

tion of property that the world has seen. We are neutral. We try to see fairly, and to see all sides. This does not mean that we have no opinion. Quite the contrary; but it means that we do not take sides with any of the contending parties. There are at least three sides to this controversy: the side of the Teutonic allies; the side of the other allies; the side of the American or the outside observer. It is not my part to determine which side is right—if there is such a thing as right in a situation of this kind—but only to state one opinion and the reasons for it. It is my privilege to state an American point of view. Of course I might not hold this point of view if I were a national in either of the sides to the conflict.

RESPONSIBILITY FOR WAR.

Much effort has been expended to lay the blame for the starting of the vast war. But it is of little consequence who sprung the trap. The great fact is that the trap had been set.

It is a singular phenomenon, this effort to escape the responsibility. For years the military establishments have been glorified, and to be part in the establishment has been accounted the highest of honor. But now the responsibility must be explained away. Where, then, is the glory of war?

The effort to explain, to justify, to escape the responsibility, is a significant phase in this catastrophe. And every explanation only exposes the more the wretchedness of the situation.

We must not take to ourselves too much luster for our escape from the present destruction. We are not essentially different, only as we are more fortunately placed on the planet and as we have a more flexible political organization. We do not have the problems.

We are not to deny or even to overlook the great results that have come from war. Virile races have forced themselves to the front and have impressed their stamp on society; the peoples have been mixed and also assorted; lethargic folk have been galvanized into activity; iron has been put into men's sinews; heroic deeds have arisen; far reaches of the imagination have been opened. The state of human affairs has been brought to its present condition largely as the result of war.

On the other hand, we are not to overlook the damaging results, the destruction, the anguish, the check to all productive enterprise, the hatred and revenge, the thieving and hypocrisy and deceit, the miserable spy system, the loss of standards, the demoralization, the loss of respect and regard for the rights of the other, the thwarting of national and racial developments which, so far as we can see, gave every promise of great results. We naturally extol the nations that have survived; we do not know how many superior stocks may have been sacrificed to military conquest, or how many racial possibilities may have been suppressed in their beginnings.

NO JUSTIFICATION OF WAR.

But even assuming the great gains that have arisen from war, this is no justification of war; it only states a fact, it only provides a measure of the condition of society at any epoch. It is probable that war will still exert a mighty even if a lessening influence; and it may still be necessary to resort to arms to win for a people its natural opportunity; but this again only indicates the wretched state of development in which we live; and so long as this condition exists, every state must be ready for defense. Undoubtedly, also, a certain amount of military training is very useful, but we have striking evidence before us that a military establishment is also very dangerous. There should be other ways, in a democracy, to secure something of this needful training.

The final conquest of a man is of himself, and he shall then be greater than when he takes a city. The final conquest of a society is of itself, and it shall then be greater than when it conquers its neighboring society.

Man now begins to measure himself against nature also, and he is beginning to see that herein shall lie his greatest conquests beyond himself; in fact, by this means shall he conquer himself—

by great feats of engineering, by completer utilization of the possibilities of the planet, by vast discoveries in the unknown, and by the final enlargement of the soul; and in these fields shall be the heroes. The most virile and upstanding qualities can find expression in the conquest of the earth. In war, the rank and file do not rise to greater heights; but in the contest with the planet every man may feel himself grow.

What we have done in times past shows the way by which we have come; it does not provide a program of procedure for days that are coming; or if it does, then we deny the effective evolution of the race. We have passed witchcraft, religious persecution, the inquisition, subjugation of women, the enslavement of our fellows except alone enslavement in war.

THE STRUGGLE FOR EXISTENCE.

Here I come to a very real situation that I want to present to you as farmers and as teachers of farmers, to you who stand close to nature and who ought to understand the meaning of the natural world. I want to ask you to interpret to mankind what is implied in the struggle for existence; for war is justified as a necessary part of the nature of things, as all organisms must struggle in order to live.

Before I enter on this subject, I must pause to say that I would not of myself found an argument either for war or against it on the analogies of the struggle for existence. Man has responsibilities quite apart from the conditions that obtain in the lower creation. Man is a moral agent; animals and plants are not moral agents. But the argument for war is so often founded on this struggle in nature, that the question must be considered. I am making these statements only in the interest of a fair interpretation of nature and, I hope, for the guidance of ourselves.

It has been persistently repeated for years that in nature the weakest perish and that the victory is with the strong, meaning by that the physically powerful. I have heard such statements from boyhood. There can be no falser teaching than this, nothing that leads men farther from the truth. It is the result of an entire misconception of the teaching of evolution.

Our minds dwell on the capture and the carnage in nature—the hawk swooping on its prey, the cat stealthily watching for the mouse, wolves hunting in packs, ferocious beasts lying in wait, sharks that follow ships, serpents with venomous fangs; and with the poet we say that nature is "red in tooth and claw." Of course, we are not to deny the struggle of might against might; but the weak and the fragile and the small have been the organisms that have persisted. There are thousands of little and soft things still abundant in the world that have outlived the fearsome ravenous monsters of ages past; there were Goliaths in those days, but the Davids have outlived them, and Gath is not peopled by giants. The big and strong have not triumphed.

I was impressed in reading Roosevelt's "African Game Trails" with the great extent of small and defenseless and fragile animal life that abounds in the midst of the terrible beasts—little, uncourageous things that hide in the crevices, myriads that fly in the air, those that ride on the rhinos, that swim and hide in the pools, and bats that hang in the acacia trees. He travelled in the region of the lion, in the region that "holds the mightiest creatures that tread the earth or swim in its rivers; it also holds distant kinsfolk of these same creatures, no bigger than woodchucks, which dwell in crannies of the rocks, and in the tree tops. There are antelope smaller than hares and antelope larger than oxen. There are creatures which are the embodiment of grace; and others whose huge ungainliness is like that of a shape in a nightmare. The plains are alive with droves of strange and beautiful animals whose like is not known elsewhere." The lion is mighty; he is the king of beasts; but he keeps his place and he has no kingdom. He has not mastered the earth. No beast has ever overcome the earth; and the natural world has never been conquered by force.

My friend went to a far country. He told me that he was most impressed with the ferocity, chiefly of wild men; and to him nature said, "eat one another." It came my time to go to that country. I saw that men had been savage—men are the most ferocious of animals, and the ferocity has never reached its high point of refined savagery until today. But I saw also that these savage men are passing away. I saw animals that had never tasted blood, that had no means of defence against a rapacious captor, and yet they were multiplying. Every stone that I upturned disclosed some tender organism; every bush that I disturbed revealed some timid atom of animal life; every spot where I walked bore some delicate plant, and I recalled the remark of Sir J. William Dawson "that frail and delicate plants may be more ancient than the mountains or plains on which they live;" and if I went on the sea, I saw the medusæ, as frail as a poet's dream, with the very sunshine streaming through them, yet holding their own in the mighty upheaval of the oceans; and I reflected on the myriads of microscopic things that for untold ages had cast the very rock on which much of the ocean rests. The minor things and the weak things are the most numerous, and they have played the greatest part in the polity of nature. So I came away from that far country impressed with the power of the little feeble things. I had a new understanding of the worth of creatures so unobtrusive and so silent that the multitude does not know them; and I remembered the prophecy that a little child shall lead them.

I saw protective colorings; I saw fleet wings and swift feet; I saw the ability to hide and to conceal; I saw habits of adaptation; I saw marvellous powers of reproduction. You have seen them in every field; you have met them on your casual walks, until you accept them as the natural order of things. And you know that the beasts of prey have not prevailed. The whole contrivance of nature is to protect the weak.

We have wrongly visualized the "struggle." We have given it an intensely human application. We need to go back to Darwin who electrified the phrase "struggle for existence" into life. "I use this term," he said, "in a large and metaphorical sense including dependence of one being on another, and including (which is more important) not only the life of the individual, but success in leaving progeny." The dependence of one being on another, success in leaving progeny—how accurate and how far-seeing was Darwin!

You know, you farmers, how diverse are the forms of life; and you know that somehow they live together and that only rarely do whole races perish by subjugation. You know that the beasts do not set forth to conquer, but only to gain subsistence and to protect themselves. You know that they do not pursue indiscriminately. You know that a henhawk does not attack crows or butterflies. Even a vicious bull does not attack fowls or rabbits or sheep. You know that the great issues are the issues of live and let live. You know that there are whole nations of plants, more unlike than nations of humankind, living together in mutual interdependence. You know that there are nations of quiet and mightless animals that live in the very regions of the mighty and the stout. And you know that you are glad it is so.

Reports For Sale at Low Price

Attention of members is called to the reduction in price of American Breeders' Association annual reports Nos. 6 and 7-8, announced on the inside back cover. In order to dispose of the stock it has on hand, and get the volumes into circulation where they will be of use, the association is offering them at one-half the price at which they were issued. This gives a unique opportunity to acquire two volumes of genetics literature at a very slight expense.

TWO CLASSES OF HYBRIDS

First Generation Differs Widely in Character from Second and Following Generations and the Two Classes Should Be Distinguished by More Exact Names, In Order to Avoid Confusion.

O. F. Cook

Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C.

THE use of distinctive names for the two principal classes of hybrids would be in the interest of convenience and intelligibility. The ordinal designations, "first generation hybrids," "second generation hybrids," "third generation hybrids," etc., are cumbersome and confusing in actual use. The Mendelian symbols "F_1," "F_2," "F_3," etc., serve for technical or esoteric writing, but are awkward typographically and have little meaning for the general reader. Both of these systems of designation are essentially misleading to the student, in that they leave out of account the biological differences between the so-called first or F_1 generations of hybrids and the second and later generations.

THE NATURE OF CONJUGATION.

Radical differences between first generation hybrids and later generations of the same stocks seemed altogether mysterious to the earlier investigators of heredity, but now are looked upon as necessary consequences of the specialized methods of reproduction followed by the higher plants and animals. The older idea of conjugation as a brief period of cellular fusion applies to some of the lower forms of life, but not to the higher. It is only among the lower organic types that the cellular body is built up in the interval between the completion of one conjugation and the beginning of another. In the higher groups the cells multiply chiefly during conjugation, that is, while the cells remain in a state of sexual fusion. The fusion that begins with the germ-cells, and gives rise to the new individual, does not cease when the growth of the new individual begins, but continues throughout its development. Beginning with the subdivision of the conjugating germ-cells, all of the cells that form the bodies of the higher plants and animals are double, with respect to their nuclear elements. Either there are two separate nuclei in each cell, or the two parental sets of chromosomes remain separate inside of the nuclei. The concluding stage of conjugation is mitapsis or fusion of the chromatin material, which finally arranges itself in the form of two long parallel threads. Conjugation is not concluded in the somatic cells, but only in the reproductive cells, as a preliminary to the formation of the next generation of germ-cells.[1]

NAMES OF THE CLASSES.

The usual object of experiments with hybrids is to analyze and recombine the characters of the parental types, and for this purpose at least two generations must be produced. As the so-called first generation of a hybrid is developed while the conjugation begun by the parental germ-cells is still in progress, it can be described as the conjugate generation. The so-called second or F_2 generation is really the first generation that can be considered as a complete product of the conjugation that was begun by the original germ-cells. The name perjugate seems appropriate because the nuclear elements represented in the second and later generations of a hybrid may be said to have passed through conjugation. Conjugate means

[1] Cook, O. F., and Swingle, W. T., Evolution of Cellular Structures, U. S. Department of Agriculture, Bureau of Plant Industry, Bulletin 81, 1905. See also, Proc. Washington Academy of Sciences, Vol. IX, pp. 191-197, 1907.

yoked together, perjugate through the yoke. In conjugate hybrids we see the results of prolonged partial conjugation, in perjugate hybrids the results of previously completed conjugation.

DIFFERENCES BETWEEN THE CLASSES.

When the original germ-cells are so different that conjugation cannot be completed, no normal germ-cells are formed by the conjugate generation, and no perjugate generation follows. The fact that it is often possible to secure conjugates from hybrid combinations that do not produce perjugates is itself an evidence that the two generations represent different phenomena of reproduction. The conjugate generation usually shows a general increase of vegetative vigor over the parental stocks, while perjugates are often weak or defective. Another general difference is that the individual members of a conjugate generation are usually alike, while the perjugates of the same stock are often very diverse. Thus when two distinct types of cotton are crossed the conjugate hybrids are as uniform as the members of the parent stocks, or even more uniform, but in the perjugate generations a wide range of characters may be shown, extending beyond the parental types as well as between them. The uniformity of the conjugates may be ascribed to the fact that the nuclear elements derived from the parent germ-cells are not fused or redistributed, but are merely associated in the same cells, much as different stocks may be united by grafting. The diversity of the perjugates indicates that the nuclear elements have formed more intimate and varied combinations.[2]

In view of these essential differences it is evident that the two classes of hybrids must be formally recognized before any useful generalizations can be framed. Of hybrids or of hybridization as a whole, little or nothing can be said that is not erroneous or misleading. All of our general statements regarding the nature, behavior or agricultural value of hybrids relate to one of the two classes, instead of to both. Conjugate hybrids are of use chiefly in plants that are adapted for vegetative propagation, while seed-propagated varieties must be secured by selection from perjugate generations. Conjugate hybrids are useful in some crops, perjugate hybrids in others. In each experiment the conjugates may be expected to show one series of biological phenomena, and the perjugates another, contrasting series. For all scientific and practical purposes it is necessary to keep in mind the differences between the two classes of hybrids, and this would be easier if distinctive names were employed.

[3] The nature and extent of the diversity that has been observed in cotton may be judged from the photographs accompanying the more detailed paper on Perjugate Cotton Hybrids by Charles G. Marshall.

A Race Betterment Exhibit

Desiring to render concrete some of the positive suggestions made at Battle Creek in January, 1914, the Race Betterment Fund (which has recently received a permanent endowment of $300,000) is arranging for a Race Betterment Exhibit in the Educational Building of the Panama-Pacific Exposition at San Francisco. The keystone of the exhibit will embody the constructive and practical methods of race betterment, viz.: preventive medicine, social and personal hygiene, child and civic welfare agencies, practicable eugenic suggestions, etc., but a certain amount of space will be devoted to the causes and evidences of race degeneracy. The Eugenics Record Office will not have an exhibit as it had planned.

PERJUGATE COTTON HYBRIDS

Amazing Diversity Characterizes Second Generation After Cross, and Affects All Characters of Plants, While First or Conjugate Generation Shows Great Uniformity.

CHARLES G. MARSHALL
Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C.

DIVERSITY in the perjugate generations of cotton hybrids must be a familiar phenomenon to all who have made the experiment of crossing two distinct types of cotton. It has been shown in numerous crosses that have been made between the Egyptian cotton and a series of Upland varieties. One of the most conspicuous examples was afforded by a series of hybrids between the Egyptian cotton and the so-called "Hindi" cotton, an inferior type chiefly known as a contamination of the Egyptian crop. The experiment of making artificial crosses between the Egyptian and Hindi cotton was not made with any idea of securing superior varieties but in order to learn the range of diversity in the Egyptian stock that might be ascribed reasonably to contamination with the Hindi cotton. The results showed that a very wide range of diversity could be induced by hybridization. With the advice of O. F. Cook detailed notes were made on a series of plants as a means of recording the nature and extent of the diversities that appeared among the perjugate hybrids.[1]

In 1910 self-fertilized bolls of a conjugate hybrid plant of Hindi x Egyptian cotton were secured by A. McLachlan, and in 1911 the seed was planted at Bard, California, in order to observe the behavior of the second or perjugate generation. Conjugate hybrids between the same stocks were raised in adjoining rows, and the essential differences between the two generations were shown in a very conspicuous manner.

Members of the conjugate generation were not only uniformly alike but showed characters intermediate between the two parent stocks. The perjugates, however, were so diverse that no two plants could be found with even a few of their characters alike. Many of the plants would not have been associated with either of the parent types, if their parentage had not been definitely known. Parental characters were not only exaggerated but in many cases entirely new characters were developed.

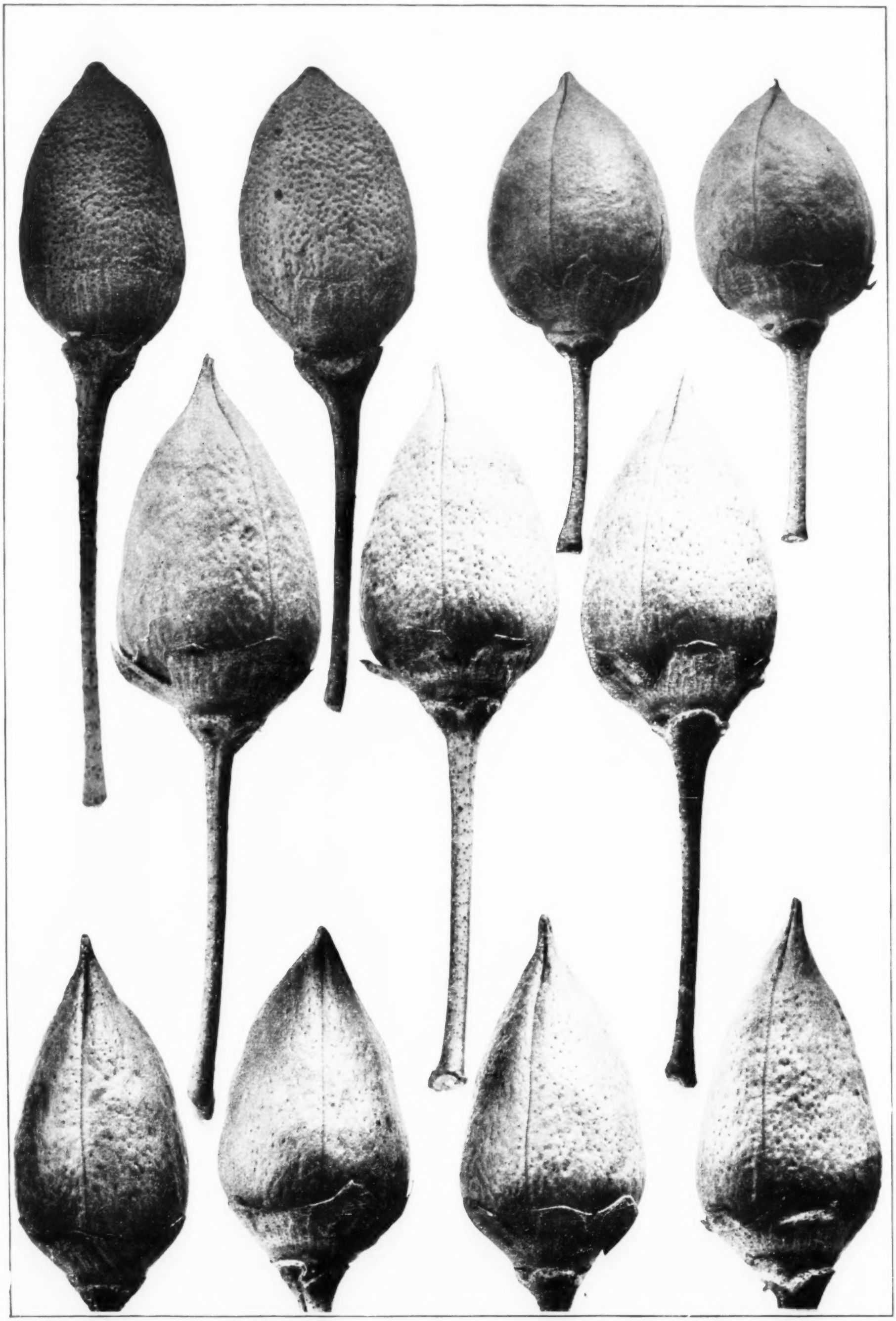
EXTENT OF DIVERSITY.

Even in their general appearance and behavior the perjugate plants showed a most remarkable range of diversity. There were all degrees of size, coloring, habit of growth and earliness of maturity. One plant might be large, light in color, strong and upright and late in maturing and the next plant in the row be small, dark in color, weak and drooping and early in maturing. Yet such completely contrasted plants might be full sisters, grown from seed of the same self-fertilized boll.

DIFFERENCE IN LEAVES AND BRACTS.

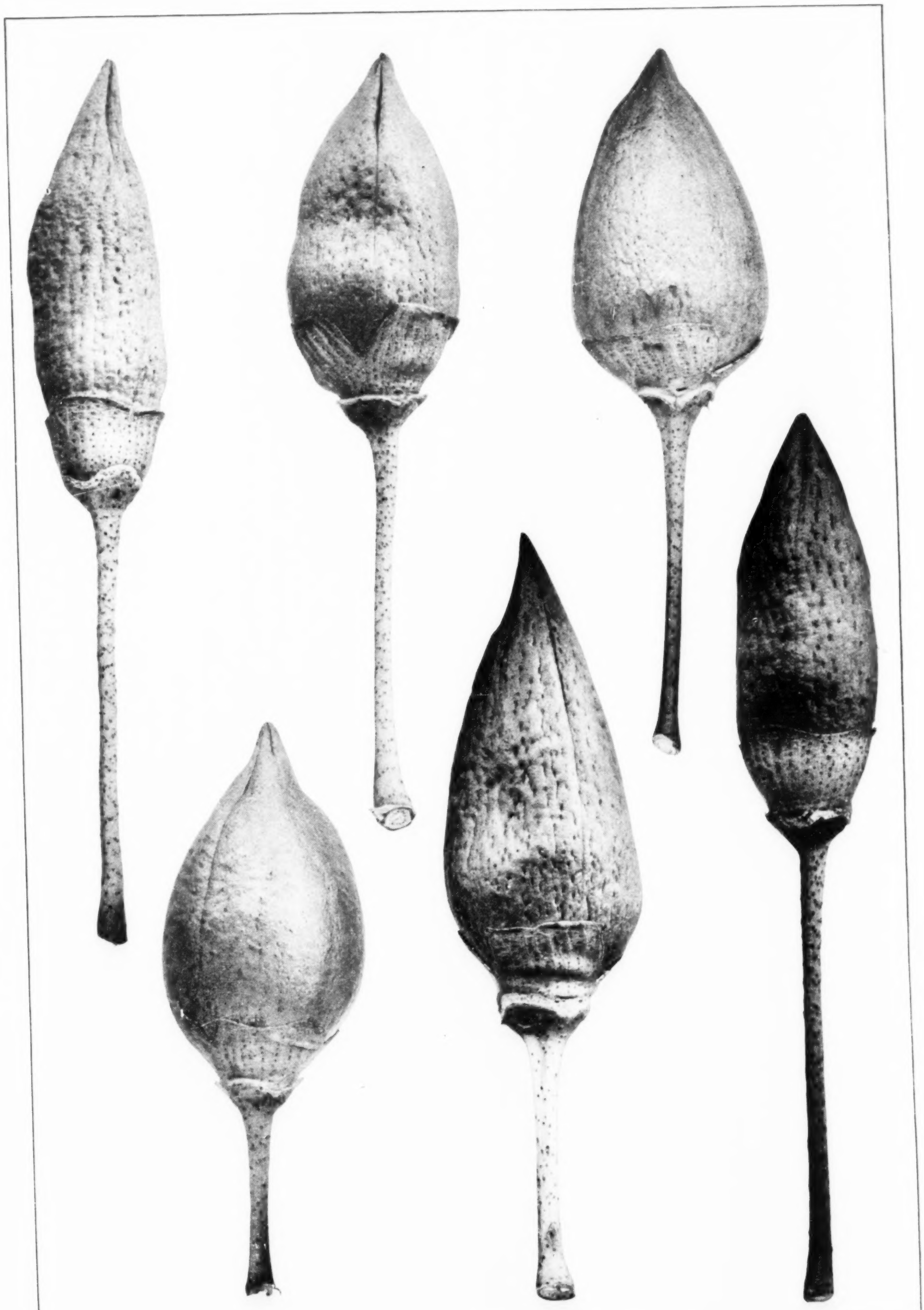
Studies of the different parts of the several plants such as the leaves, involucral bracts, bolls and seeds, revealed as great diversity and range of differences among these more detailed characters as there was in the general appearance and habit of growth of the plants. Many combinations of these characters were to be found in the different plants but no two plants were found that appeared to have the same combination, nor was it possible to

[1] Cook, O. F., Hindi cotton in Egypt, U. S. Department of Agriculture, Bureau of Plant Industry, Bulletin 210, 1911, and Heredity and Cotton Breeding, Bulletin 256, 1913.



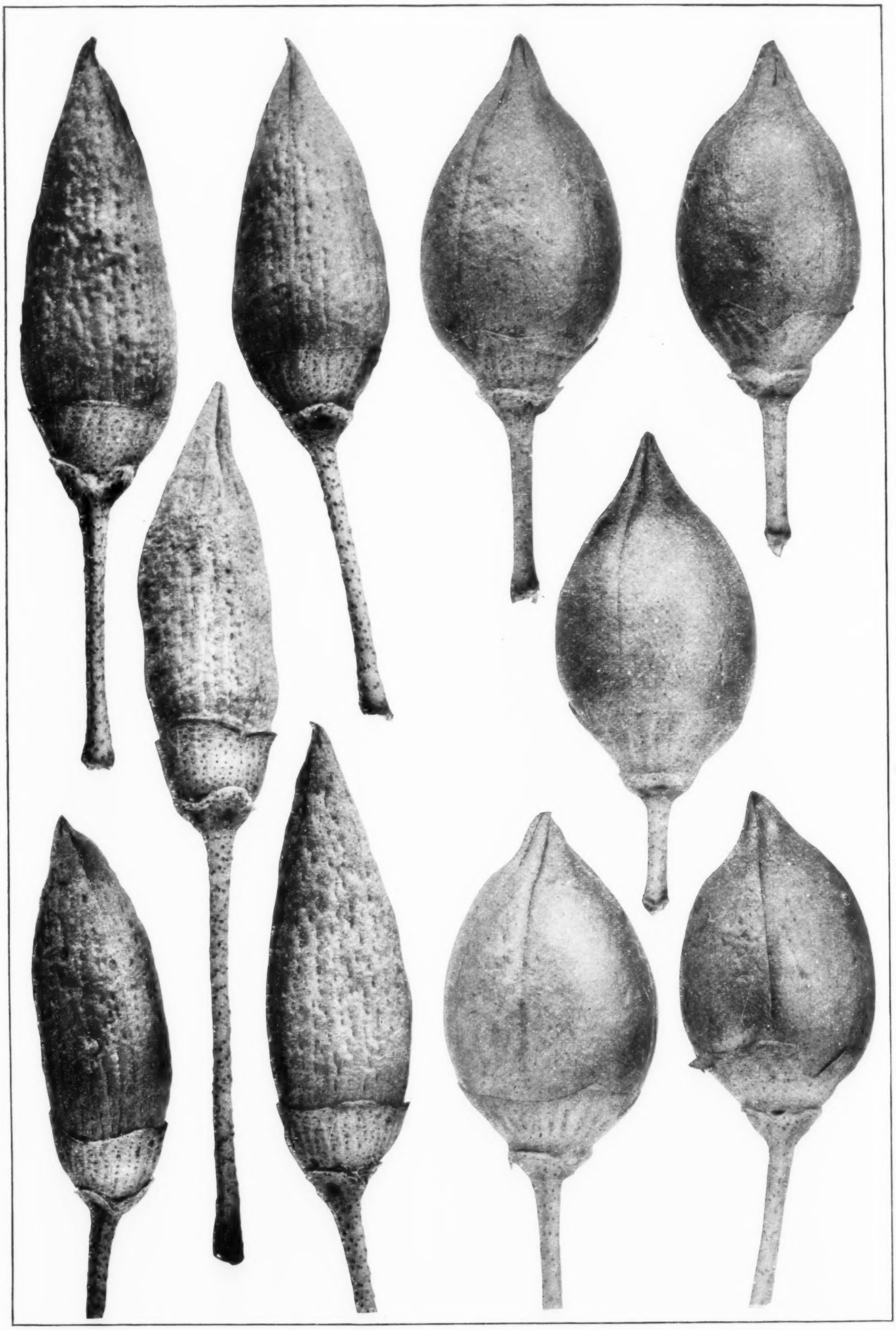
CONJUGATE HYBRID AND ITS PARENTS

Two upper left-hand bolls are Egyptian cotton, the two upper right-hand bolls Hindi cotton. A cross between these two types produced cotton which was quite uniform; the bolls of this conjugate hybrid generation are shown in the center and lower part of the photograph. Their uniformity is to be contrasted with the diversity shown in hybrids of the second or perjugate generation, as exhibited in the following illustrations. Photo natural size. (Fig. 1.)



BOLLS OF PERJUGATE HYBRIDS

They represent the second generation from a cross of Egyptian and Hindi cottons. The six specimens represent six consecutive sister plants raised from seeds from the same boll of the conjugate parent, produced from a self-fertilized flower. Compare the diversity of these bolls with the relative uniformity shown by the conjugate generation in the preceding illustration. Photograph natural size. (Fig. 2.)



BOLLS OF PERJUGATE HYBRIDS

Five bolls from each of the first two sister plants represented in fig. 2, the progeny of a cross between Egyptian and Hindi types of cotton. By comparing the left-hand side of the plate with the right-hand side, a vivid impression of the nature and extent of differences of boll characters among perjugate hybrids can be gained. Photograph natural size. (Fig. 3.)

discover any general correlations or definite associations between any of the more important structural differences.

The leaves of the different plants varied in color from a light or yellowish green to a very dark green, some of the plants showing a bronze or reddish tinge. They also varied in shape from simple leaves to leaves with deeply cut lobes, with margins wavy or crenate in many different degrees. There was the same variation in the glossy or hairy surfaces, as well as in texture and veining; in fact the leaves of sister plants were often so different that they might well have represented as many distinct types of cotton.

Figure 4 gives an idea of some of the differences and peculiar characteristics of the involucral bracts of five of the perjugate hybrid plants. The bracts not only differed in size, shape, texture and coloring, but many of them revealed in their position around the boll new traits entirely foreign to either of the parent stocks. In one case the bracts performed a peculiar twist at the ends, leaving the boll exposed and giving the appearance of a toy pinwheel, especially if viewed from above. The bracts of another plant were very large and concave or inflated, completely enclosing the bolls.

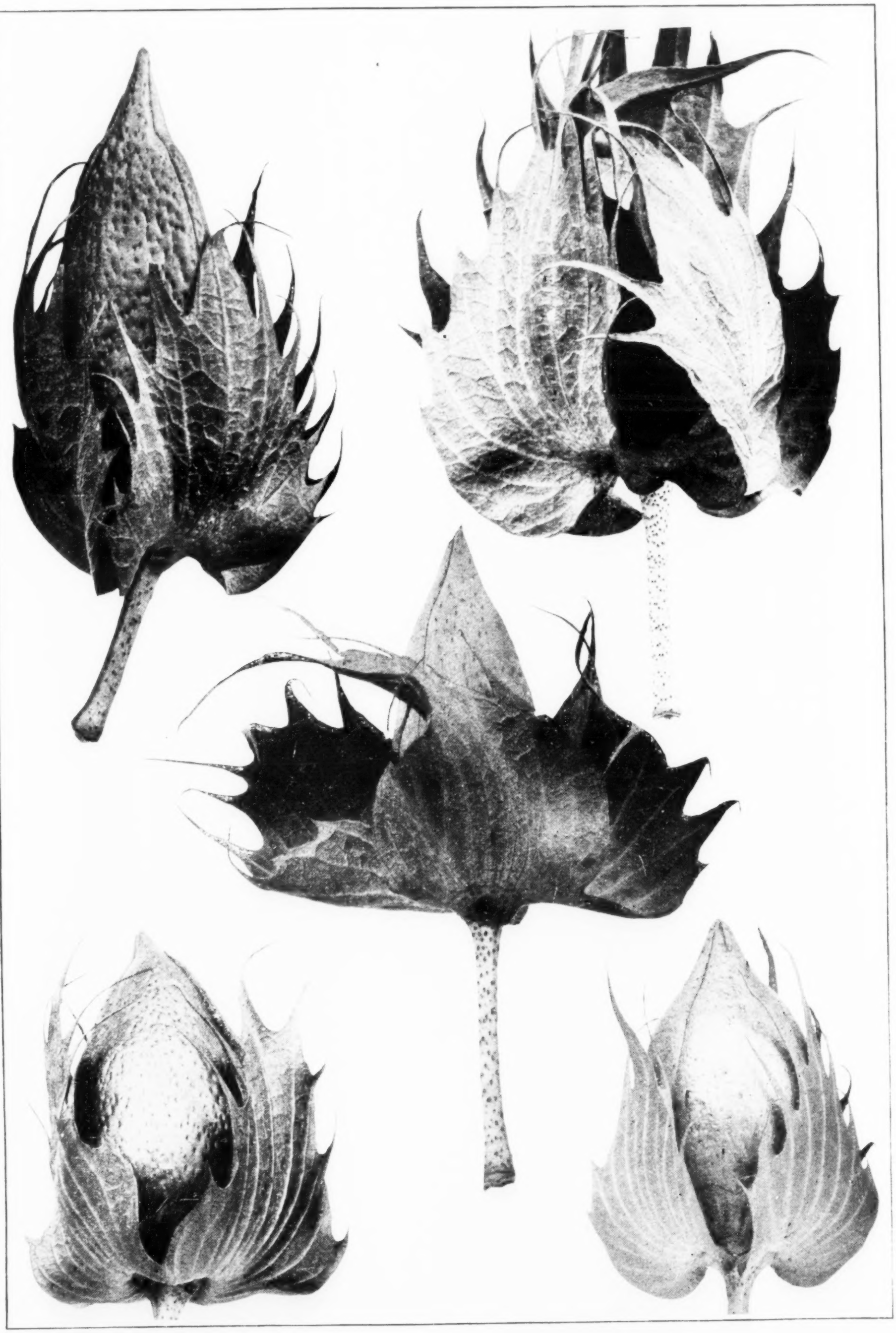
DIFFERENCES IN BOLLS AND SEEDS.

The extra-floral nectaries, which are one of the specialized features of the cotton plant, also showed many aberrations, and sometimes marked degeneration. The general tendency seemed to be toward a smaller development of nectaries than in the parent stocks. On the majority of the plants the nectaries both of the leaves and involucres were very small and inactive or altogether absent. One plant, however, had very large and active nectaries, larger than is customary with either of the parent stocks. Another plant had one active nectary on the midrib of the leaf and the nectaries inside the involucral bracts were large and active, but those on the outside of the involucral bracts were inactive, and often lacking altogether.

The bolls of these perjugate hybrids were perhaps more striking in their diversity and possession of strange characters than any other parts of the plant. There were many shapes, some very unusual and freakish. The bolls of one plant were very long and narrow, almost cigar-shaped. Another plant had bolls almost round but with a beak as long as, and in many cases longer than, the body of the boll. Still another plant had small bolls with blunt ends and a constriction at the middle which made them look like peanuts. Some plants had large bolls and some small, some had bolls dotted with numerous oil glands and some with few, some plants had bolls deeply pitted and some had bolls with smooth surfaces, the oil glands being more deeply buried in the tissues of the wall.

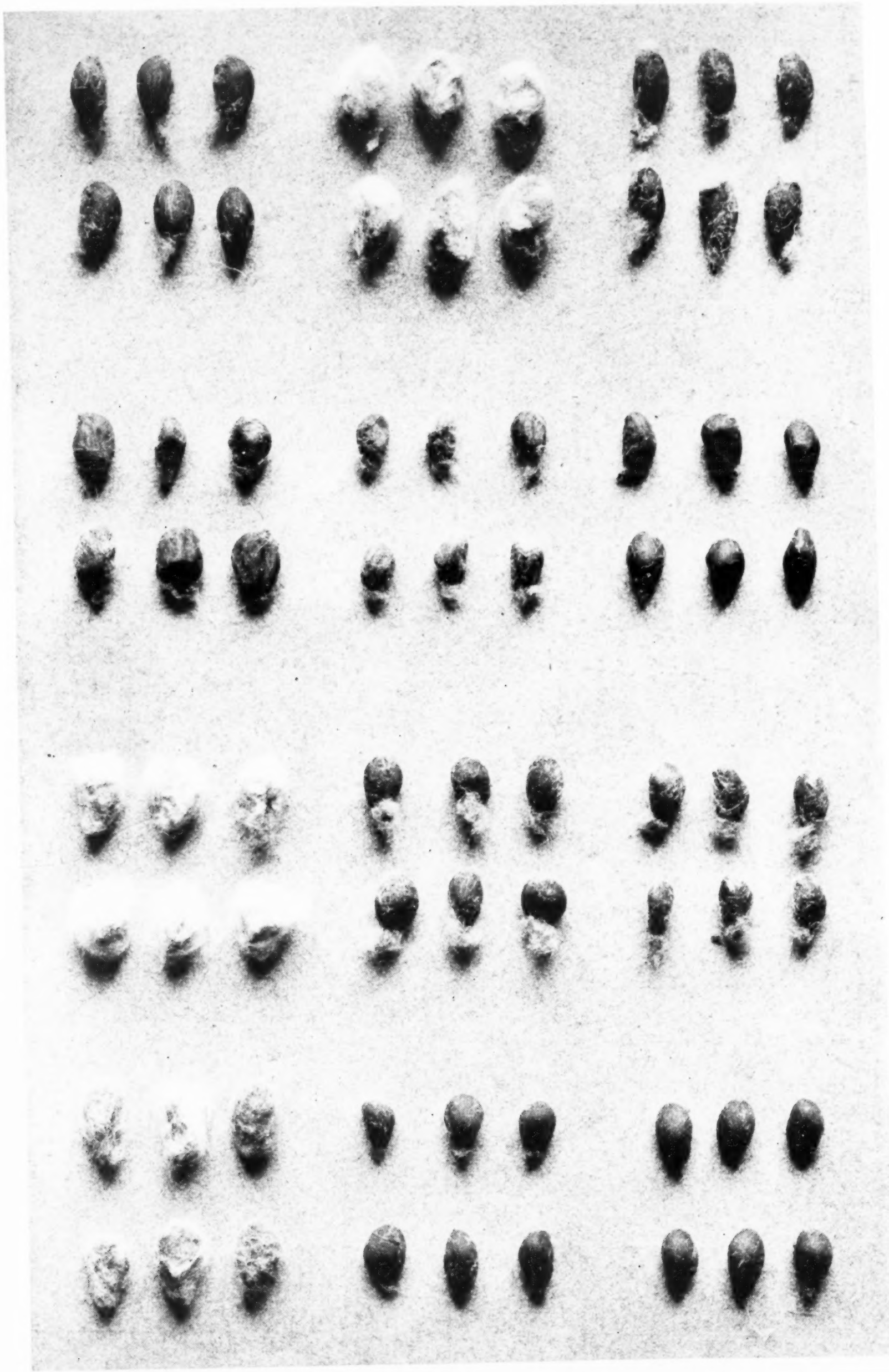
The seed and lint characters were as diverse as the boll characters. The seeds from the different plants were of many sizes and shapes and no two plants showed the same distribution of fuzz on the seed. The seed of one hybrid plant was entirely naked while usually there were tufts of fuzz at either the apex or base of the seed or at both ends, these tufts varying in size for the different plants. Several plants had the seeds completely covered with thick fuzz, but even these differed from each other in that some had green fuzz, some brown and some pure white. The lint also varied greatly in both quantity and quality and ranged in color from a pure white to a decided buff. From a commercial standpoint the lint would have been of little value because of the variation in length and quality of the lint from the different plants.

A few descriptions of individual Hindi-Egyptian hybrid plants of the perjugate generation may help to show how diverse they were, and how in many cases their characters ranged beyond either of the parent stocks. The plants here described were grown from self-fertilized seed of one conjugate Hindi x Egyptian plant. The first six plants were grown from seed of one boll, the next three from another boll and the last three from a third boll. No attempt is made to cover all the



BRACTS OF PERJUGATE HYBRIDS

Involucral bracts of the perjugate hybrids between Egyptian and Hindi cottons, representing five of the sister plants shown in fig. 2. Note the difference in form, size, position and texture of the bracts. Photographs natural size. (Fig. 4.)



SEEDS OF PERJUGATE COTTON HYBRIDS

The 12 groups represent 12 sister plants of the second generation from the cross of Egyptian and Hindi cottons. The first six are the same plants represented by the bolls in fig. 2, the next three are from another self-fertilized boll of the same mother-plant, and the last three are from still another boll of the same mother plant, also self-fertilized. In addition to the differences in size and shape of seed and in texture and distribution of fuzz, these seeds differed in the color of the fuzz and the length, color and quality of the lint. Natural size. (Fig. 5.)

points of difference, but merely to state the features in which the plants differed most noticeably from each other and from the parental types.

INDIVIDUAL PLANTS.

No. 1. Plant large with heavy foliage and reddish branches; leaves large, slightly crenate with well developed active nectaries. Involucral bracts with a reddish tinge, medium sized, triangular, joined slightly at the base and lying close to the boll. Bolls large, irregular in outline, long and tapering from broad base to a tapering beak at the end, deeply but not closely pitted with oil glands. Seeds nearly naked with small tufts of fuzz at both ends.

No. 2. Plant medium sized, and light colored. Leaves glossy, very slightly crenate, with nectaries lacking or inactive. Involucral bracts very large with long irregular teeth. The bracts concave and inflated, completely covering the boll. Shape of bolls much the same as those of No. 1, but smaller and fuller, smoother, and more glossy, with more oil glands. Seeds large, round with thick green fuzz.

No. 3. Plant large and light colored, with slim weak branches. Leaves large, with slightly crenate margins and one active nectary on the midrib. Involucral bracts coarse in texture, long and triangular, strongly twisted to one side, thus leaving the boll exposed. Bolls narrow oblong, very long and slim, deeply pitted and with no gloss. Seeds long and nearly naked, but with small tufts of fuzz at both ends.

No. 4. Plant large and luxuriant, with dark foliage. Leaves decidedly crenate, and more hirsute than those of preceding plants. Involucral bracts large, with coarse teeth, triangular and not cordate at the base but joined together for a half inch. Bolls of medium size tapering from above the middle, to a short point, and intermediate in color with numerous oil glands, glossy and smooth. Seed small, round, nearly naked, with small tufts at both ends.

No. 5. Plant large, strong and vigorous, but very late in maturing. Leaves large, upright, crenate, light in color, with dull surfaces and small nectaries. Involucral bracts rather small, triangular, scarcely cordate at the base, and but slightly joined. Bolls conical oval, full, very glossy, numerously dotted but not deeply pitted with oil glands. Seed rather long, nearly naked, with very small tufts at both ends.

No. 6. Plant small, dark in color, very productive and early in maturing, in many respects exactly the opposite of No. 5. Leaves small, glossy with straight, even margins, broad and not as deeply lobed as preceding plants; but one nectary on leaves, but that large and active. Involucral bracts small, triangular with even teeth, neither cordate nor joined at the base. Bolls small, almost round, with a short, rather blunt beak, glossy and numerously dotted but not deeply pitted with oil glands. Seeds small, nearly naked, with no tufts of fuzz.

No. 7. Plant very large with many vegetative branches and no fruiting branches developed for four feet up the main stalk. Leaves large, with broad lobes very slightly cut and very often simple. Leaves light in color, but with a bronze tinge and very glossy. Bracts very small, round, evenly toothed and lying close to the boll, bronze in color. Boll of medium size, round, full, tapering abruptly into a thin pointed beak, dark, glossy and abundantly and deeply pitted with oil glands. Seed large, round, covered with thick white fuzz.

No. 8. Plant tall and dark in color. Leaves small and strongly crenate, dark and glossy, showing but one nectary. Bracts small, triangular, not cordate at the base but joined, with a copper tinge. The ends of the bracts twist to the side, thus leaving the boll exposed. Bolls like those of plant No. 7. Seeds large, round and nearly naked with a large heavy tuft at base.

No. 9. Plant tall and weak with red drooping branches, very productive and early in maturing. Leaves large, with deeply cut lobes, light in color, not glossy. Bracts of medium size, more round than triangular, with teeth curving outward. Their special feature is that they are strongly concave or inflated, forming a balloon-like enclosure around the boll. Bolls of medium size, long, tapering gradually from the middle to a beak, light in color, the surface rough and deeply pitted with oil glands. Seeds small, covered with thin fuzz and a small dense tuft at base.

Plant 10. Plant medium sized, sturdy and early in maturing. Leaves of medium size, light in color, not glossy, not crenate and almost square in shape with two or three well developed nectaries. Bracts medium sized, reddish, round, slightly inflated and inclined to twist to one side at the ends, very cordate at the base, but not joined. Bolls medium sized, oval tapering to a blunt beak, light in color, glossy with few oil glands. Seeds large, angular and covered with greenish fuzz.

Plant 11. Plant small, dark in color and early in maturing. Leaves medium sized, broad, with narrow sharp lobes, the margins strongly crenate, the leaf nectaries present and active. Bracts very small, triangular with short teeth, the division of the three teeth at the end of the bract showing plainly, slightly cordate and joined at the base. Bolls small, tapering abruptly from below the middle to a blunt point, light in color, not glossy, with few oil glands. Seed medium sized, angular, nearly naked, with very small tuft at base.

Plant 12. Plant small and weak, light in color. Leaves intermediate in size and color, but slightly crenate. Bracts small, with a reddish tinge, round, with short teeth, slightly cordate, but not joined at the base. Bolls large, tapering from the middle into a blunt beak, light in color, smooth, glossy, full, oval. Seeds large, plump and completely naked.

E. S. CARMAN

One of the Greatest of American Plant Breeders—His Work Too Little Appreciated—Success With Potatoes Most Noteworthy—His Activity as a Journalist.

E. M. East
Bussey Institution, Forest Hills, Massachusetts.

IT IS a delightful epigram but hardly the actual truth that "If a man preach a better sermon, write a better book, or build a better mouse-trap than his neighbor, though he hide himself in the wilderness, the world will make a beaten path to his door." The world as a whole is likely to give its applause to some very unimportant people. And after all is it not probable that too general a commendation encourages superficial rather than solid work? The anti-socialistic argument that a more even distribution of earthly comforts would oppose progress because it limits ambition is a pure sophism. Few things worth doing have been done with either money, power or fame in view. For this reason there is no need to feel sorry that E. S. Carman, great alike as agricultural journalist, public spirited citizen and creator of new varieties of plants, never received the panegyrics of which some others have been since the recipients. He had the happiness described by Marcus Aurelius: "A man's happiness—to do the things proper to man." Not that Mr. Carman was unknown—perhaps the editor of no rural paper was admired and trusted more—but, even with the temptation of a private medium for exploiting his triumphs, he did no more than describe carefully and impartially success and failures alike with the honesty of a true nature-lover and born investigator.

Mr. Carman would probably have denied that he was a great plant breeder. He originated no new methods and made few contributions to the study of heredity; but he did discover many interesting facts during his hybridization experiments and he added hundreds of millions of dollars to the wealth of the country, keeping nothing for himself. He was a national benefactor, and who will say he was not a great man when he placed public service before private gain? His attitude in the matter is summed up in the final paragraph of an article on the five famous potato varieties placed on the market between 1882 and 1896. "It will now appear that for our 16 years of potato work, we have sold five kinds for precisely $1,000. We dare say that, had we used our columns for advertising the three kinds now offered for sale, retaining the entire control as long as possible, *The Rural New-Yorker* might easily have made a snug little fortune. But, tell us friends, were we to crack up the plants that have originated at the "Rural Grounds" while we sold them to you either directly or indirectly, do you think that you would place as much confidence in the thorough impartiality of our plant reports, as you do now?" Ten years ago the writer made a trip through the great potato regions of Wisconsin and Minnesota. During it one of the most successful and best informed growers stated that in the previous decade 80% of the potatoes of the country were either Mr. Carman's productions or seedlings from them. How much truth there was in this statement it is impossible to say, but discount it as much as one will, can it be said that there is no such thing as altruism?

POTATO CREATIONS.

The famous potatoes from the Rural Grounds were Rural Blush, Rural New-Yorker No. 2, Carman No. 1, Carman No. 3 and Sir Walter Raleigh. They

were not raised from hand hybridized seed, though this had been the original intention. Sixty-two varieties were grown as prospective parents, but crossing proved impossible; no functional pollen was formed. A few natural seed berries were found, however, and from them after years of testing these five kinds proved to be the fittest. Even the records of the maternal parents were lost, but the goal set at the beginning was reached. New potatoes better than the old Early Rose and Peachblow were produced. Considering the amount of time and space at command, it was probably the most successful practical plant breeding experiment ever tried.

In all of the other hybridization work, Mr. Carman made careful castrations of the flowers used as female parents, protected the blossoms from foreign pollen and made the crosses by hand. "Guess work in hybridization or crossing," he says, "is altogether abominable, because it is impossible to know whether anything has been effected or not, while the variations sure to appear in the seedling plants, it will be assumed, are evidences of cross-bred parentage."

One of the most interesting pieces of work brought to a successful conclusion, was a cross between the beardless Armstron , wheat and rye made in 1882. Several varieties from this cross were finally introduced, but whether they battled successfully with pure wheats or ryes, I have never heard.[1] The important thing was the variation in a first hybrid generation which was conclusively demonstrated—work which it would be interesting to repeat even now as the constancy or comparative homozygosity of the parents was unknown—and the pioneer work of showing the possibility of making crosses between these two generically different cereals. Mr. Carman saw the salient point very clearly as the following quotation shows: "What do they promise? If the hybrids give us a grain less valuable than rye or wheat, nothing will be gained in this case, except the curious fact that a cross between two different genera of grain is possible. This established, however, the way is opened for further hybridization the pregnant results of wh'ch can only be guessed at."

Another int resting specific cross made by Mr. Carman was between the blackberry and the raspberry. It gave nothing of commercial importance, though by repeating it Luther Burbank is said to have produced a valuable berry. Neither Mr. Burbank nor Mr. Carman, however, was the first to make this cross; Mr. Carman, himself, admits obtaining the idea from William Saunders of London, Ontario, who had produced similar hybrids some five years before.

WORK WITH SOLANUMS.

Mr. Carman's taste evidently was partial to the Solanaceæ. He worked for many years on tomatoes, and succeeded in isolating from his various crosses five types that were worthy of introduction to the trade. They were the Longkeeper, Lemon Blush, Terra Cotta, Autocrat and Democrat. Autocrat and Lemon Blush were known for years as the finest of their kind. He also crossed the common tomato with both the Currant Tomato *L. pimpinellifolium* and the nearly related genus Physalis. Whether any valuable types were produced from the first cross or not, I have been unable to find out, but it was demonstrated that the first hybrid generation was intermediate in character and that a few of the individuals of the latter generations combined a fairly large size of fruit with the racemic type of inflorescence. The generic cross was not sufficiently fertile to be propagated, and died out after a couple of generations.

Various other crosses of all kinds kept up the interest of Mr. Carman in his work, in which he was efficiently and enthusiastically aided by Mrs. Carman,

[1] W. Van Fleet, who was associated with Mr. Carman in his breeding work, states that none of the real hybrid types survived continued propagation. Segregation occurred to such an extent that the progeny soon became, to all appearances, either rye or wheat. None of the rye types proved of particular value, but several of the wheat types are still in use. Farmers Bulletin No. 616 of the U. S. Department of Agriculture, "Winter Wheat Varieties for the Eastern States," recommends the soft "Rural New Yorker No. 57," one of Carman's creations.—The Editor.

although with one exception the rose hybrids were the only ones that were extremely valuable. This was the Carman Gooseberry. Here was a gooseberry that might have revolutionized gooseberry growing since in a limited test it was mildew proof, but unfortunately the seed firm to which it was sold was unable to propagate it.

The roses were perhaps the real attraction of the "Rural Grounds." The *Rosa rugosa* of Japan was the foundation stock, and upon it were crossed first the Austrian hardy yellow rose known as Harrison's Yellow, then Hybrid Perpetuals and afterwards Hybrid Teas. From these crosses hundreds of plants were raised—most of them, of course, worthless, but some of remarkable beauty. From the first cross mentioned came the Agnes Emily Carman, a fine, hardy, longlived, though thorny variety. In color it was like the Jacqueminot, but many times as profuse in blossoming. From other crosses came procumbent roses, hedge roses, tea roses, etc., etc. They did not attain pre-eminence as did the potato varieties but they helped and still help to brighten many a flower garden.

Elbert S. Carman was born on November 30, 1836, in Hempstead, Long Island. He entered Brown University in 1854, rooming with John Hay. He was obliged to withdraw after two years of work, however, on account of illness. In 1873, he married Agnes E. Brown, by whom he had two children. Immediately after his marriage he moved to River Edge, N. J., where he began to plant and experiment on the place that afterward became so well known as the "Rural Grounds." While here he became so interested in Moore's *Rural New-Yorker* as a contributor, that he purchased the paper and became its editor in 1876. Through an absolutely open and honest policy, he made this journal a power in the agricultural world. For many years it has stood out against all frauds and impostures to the farmer, even though this went against its monetary interests. Mr. Carman died February 28, 1900, regretted by the many friends he had made in his editorial capacity, who wrote of him like the hero of Leigh Hunt's ever popular poem, "as one who loved his fellow men."

The Chromosome Hypothesis of Heredity

A working hypothesis of some sort is an essential tool of an advancing branch of experimental science. It behooves us in the study of heredity to use the best hypothesis we have, until it is replaced by a better.

The chief objections to the chromosome hypothesis, so far as I can gather them, are:

1. The English pioneer, Bateson, used instead the working hypothesis of somatic segregation.
2. The chromosome hypothesis does not appeal to physiologists and chemists.
3. The affairs of the chromosomes may be regarded as a consequence instead of as a cause.
4. Many of the changes of chromosomes and nucleus are still uncertain.
5. The chromosome hypothesis was discredited by Weismann's extensive and untested speculations

On the other hand, there are advantages in the use of the chromosome hypothesis.

1. Bateson's counter hypothesis of somatic segregation has proved barren, and appears to be contradicted by certain facts.
2. Strasburger's unrivalled experience found the chromosome hypothesis to fit the facts of plant cytology as well as those of inheritance.
3. The chromosome hypothesis fits the breeding facts of the Cambridge school even better than their own hypothesis.
4. It has been used as a fertile working hypothesis by Morgan and his fellow-workers in their unique experiments at Columbia University.
5. It seems to be coming more and more into use in accounts of research in plant breeding. It has, I think, no serious rival. Whether we like it or not, it appears to be here to stay.

It must be remembered that an experimenter does not usually question whether the hypothesis he uses is true or false, but whether it is useful or barren in leading to new experiments or connecting up facts. Working with it will soon show whether it is good or bad.

JOHN BELLING, *Florida Agricultural Experiment Station.*

JERSEY-ANGUS CATTLE

Cross Produces Diversity of Types and May Lead to Establishment of Valuable New Breed Which Will Combine Dairy and Beef Characteristics and Be Hardy.

ARTHUR H. KUHLMAN
Department of Animal Husbandry, University of Wisconsin, Madison, Wis.

ON HIS country estate near the little village of Thirsk in northern England, Frances B. Samuelson is making a practical application of Mendelian principles in producing a herd of cattle adapted to the conditions of that locality. Stockmen of northern England and southern Scotland claim that numerous attempts have been made to introduce the Jersey breed into those sections but apparently the Jersey is not able to adapt itself to the climatic conditions of this region and has failed to thrive. The strictly beef breeds do well, but according to Mr. Samuelson's ideas do not produce the desired quantity or quality of milk.

In trying to produce an animal that would fulfill all of these conditions, Mr. Samuelson began crossing Shorthorns and Jerseys, but as the subsequent offspring showed such a variety of colors, resulting in a decided lack of uniformity in the color markings of the herd, this cross was abandoned. About seven years ago the Jersey-Angus cross was begun. Five typical pure bred Jersey cows were mated with a pure bred Aberdeen-Angus bull. Five F_1 females (one of these is shown in Fig. 6) obtained from this cross were in turn mated with an F_1 bull. The F_2 heifers were then mated with an F_2 bull.

The F_1 generation has many of the outward appearances of the Angus, being black or dun in color, polled and rather beefy in conformation. Milk records of all the cows are being kept and the F_1 cows show a high yield of milk and butter fat, ranking almost as high as their Jersey dams. These cross-bred cows have very uniform and good sized udders and seem to be good dairy animals. They are also more hardy than their dams, requiring less close housing during the winter. In fact open sheds have been found to furnish sufficient protection for all the young stock and the warm stables needed to house the Jersey cows proved too warm for the cross-breds.

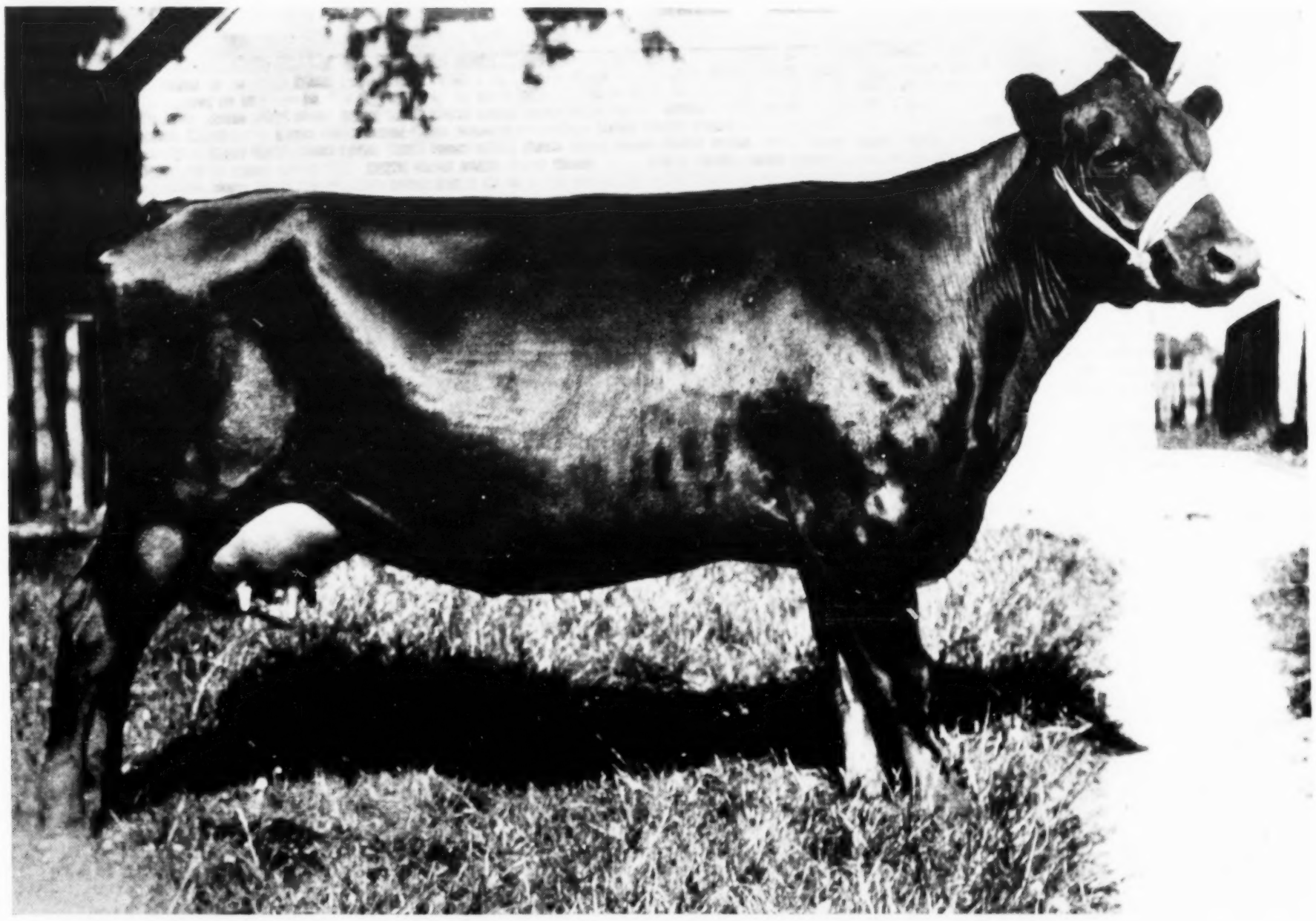
HIGH MILK PRODUCTION.

One of the F_2 cows (Fig. 7) in milk last summer when I saw the herd, was giving 30 pounds of milk daily which tested over 4% butter fat. During her first lactation period she produced 4,110 pounds of milk. She is a dark or brindled fawn having many dairy characteristics but is rather more beefy than a Jersey.

Sixty animals are numbered and entered in the herd records but only 20 are now in the herd, which at the present time consists of the following

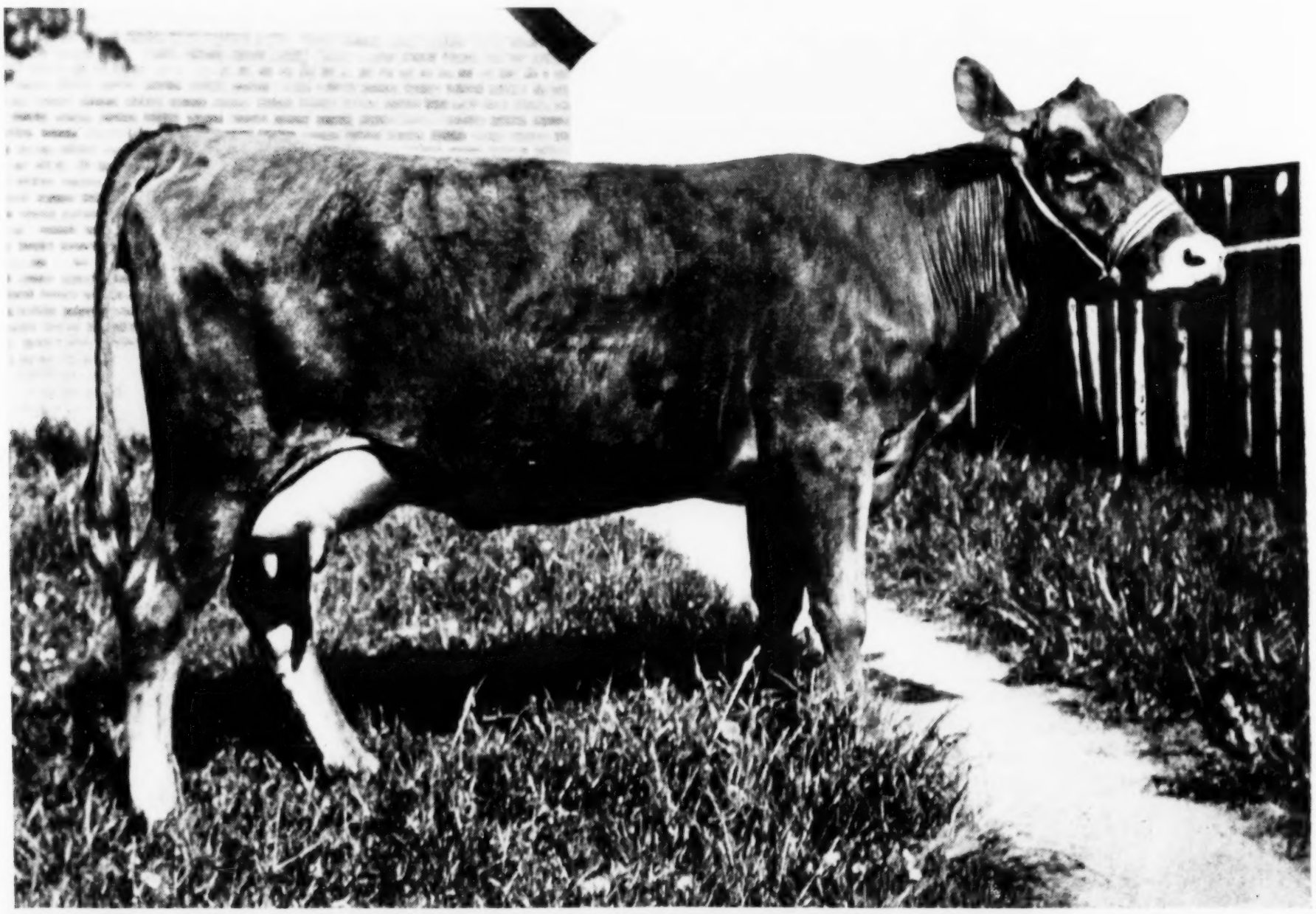
2 Jersey cows.
6 F_1 cows.
2 F_2 bulls (Figs. 8 and 9).
8 F_2 females (see figs. 7, 10 and 11).
2 F_3 calves.

As stated above, all the F_1 individuals are black. Among the F_2 progeny four heifers and a bull are black like the F_1 individuals, one heifer is black with gray hairs on her face, a bull and a heifer are brindled fawn, and two heifers are very dark fawn with light fawn markings around muzzle, ears and inner thighs. Six of the F_2 heifers are distinctly polled like the Angus while two have a square poll like a heifer that has been dehorned. The F_2 yearling bull that has been selected as stock bull (Fig. 8), has many Jersey characteristics as regards form of head and body. He is perhaps more of the dairy than the beef type, is reddish



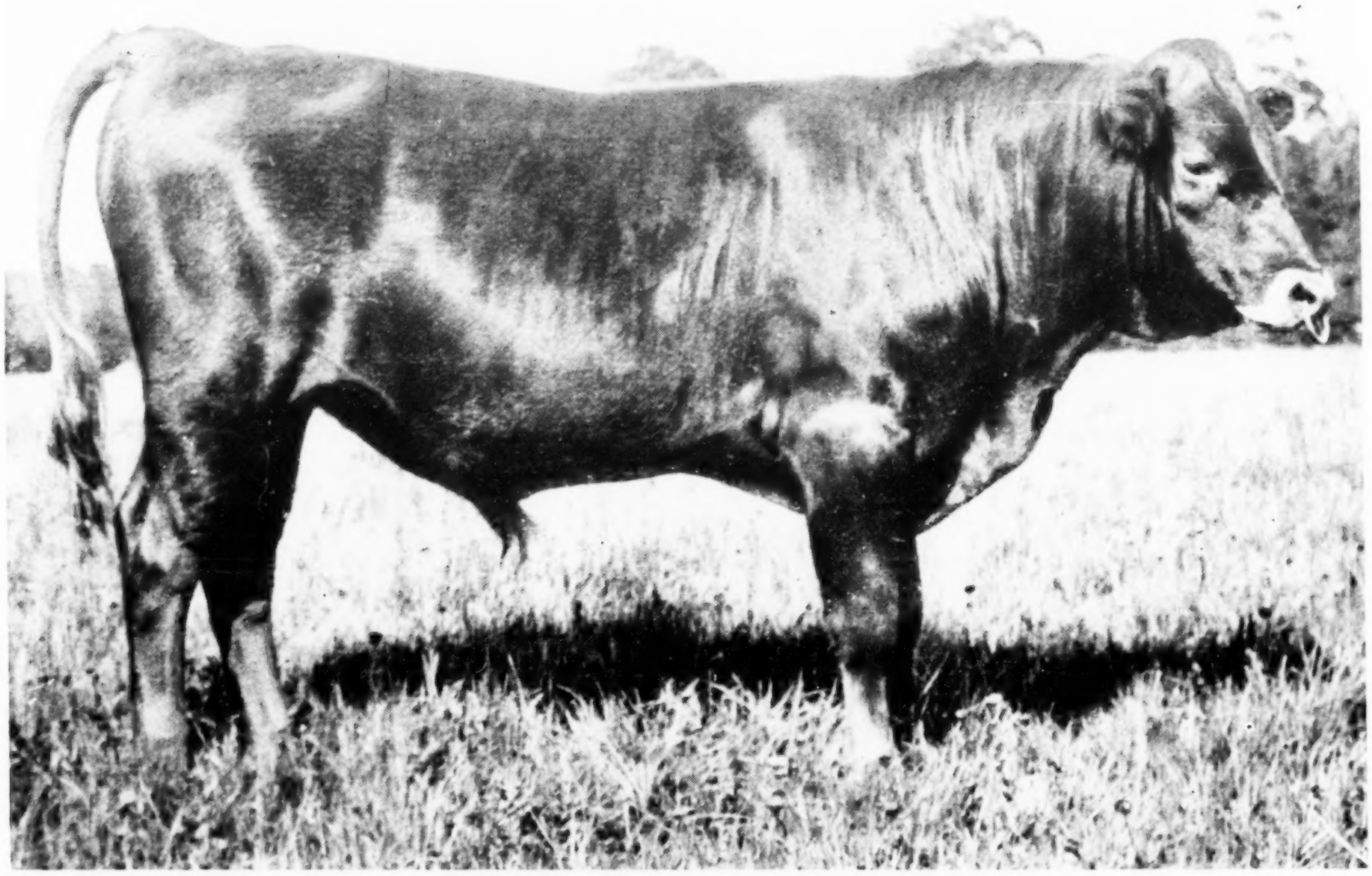
FIRST GENERATION JERSEY X ANGUS CROSS

A smooth neat cow with a good udder, who shows the characteristic poll of the Angus and is somewhat beefy. The breeder is attempting to combine the unrivaled milk yield of the Jersey with the hardiness and beef quality of the Angus. (Fig. 6.)



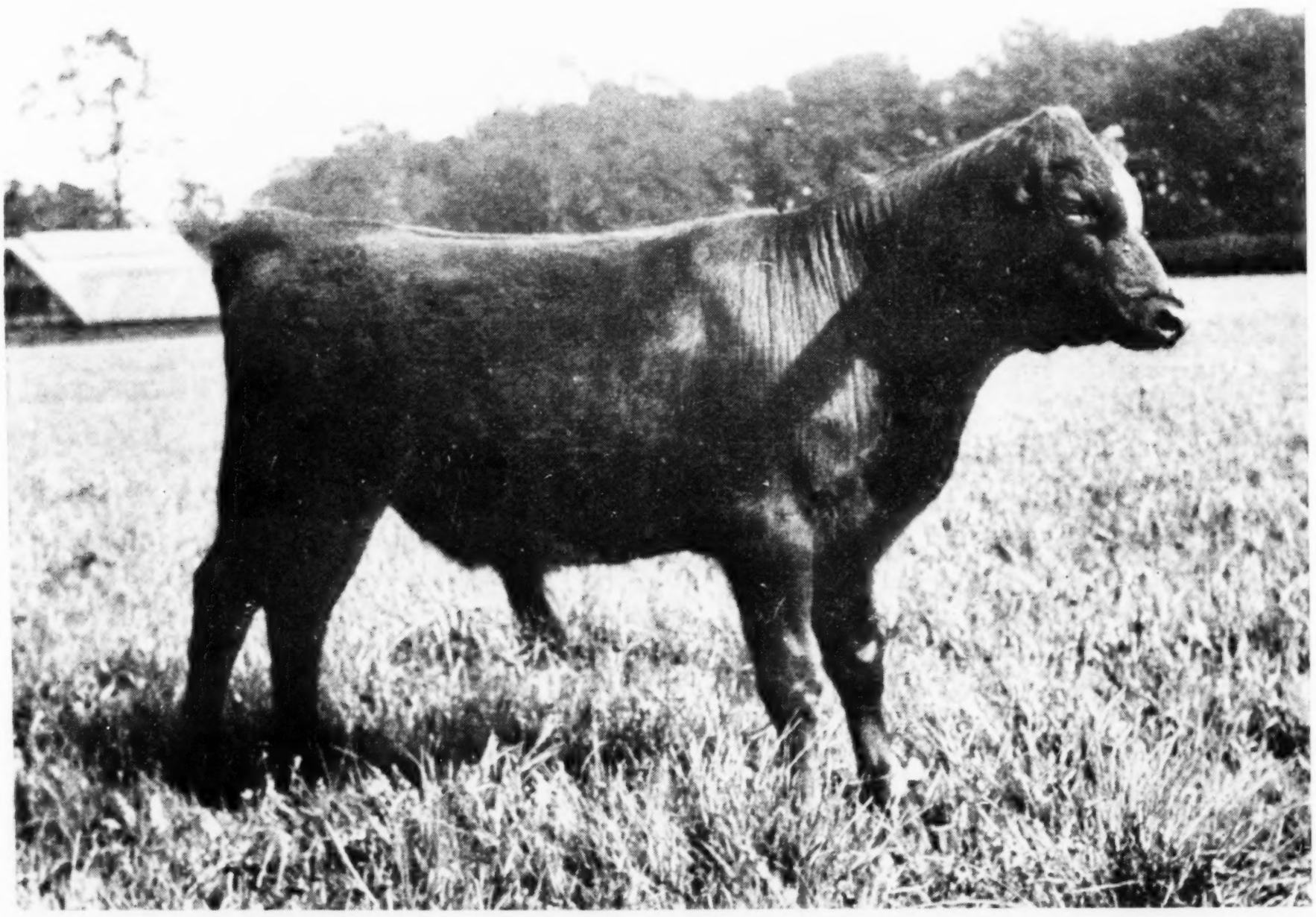
SECOND GENERATION HEIFER

This cow, orange-fawn in color, shows "dairy form" and is proving a good producer. The fawn colors are preferred by the breeder, although many of the progeny of the cross have been black or dark. (Fig. 7.)



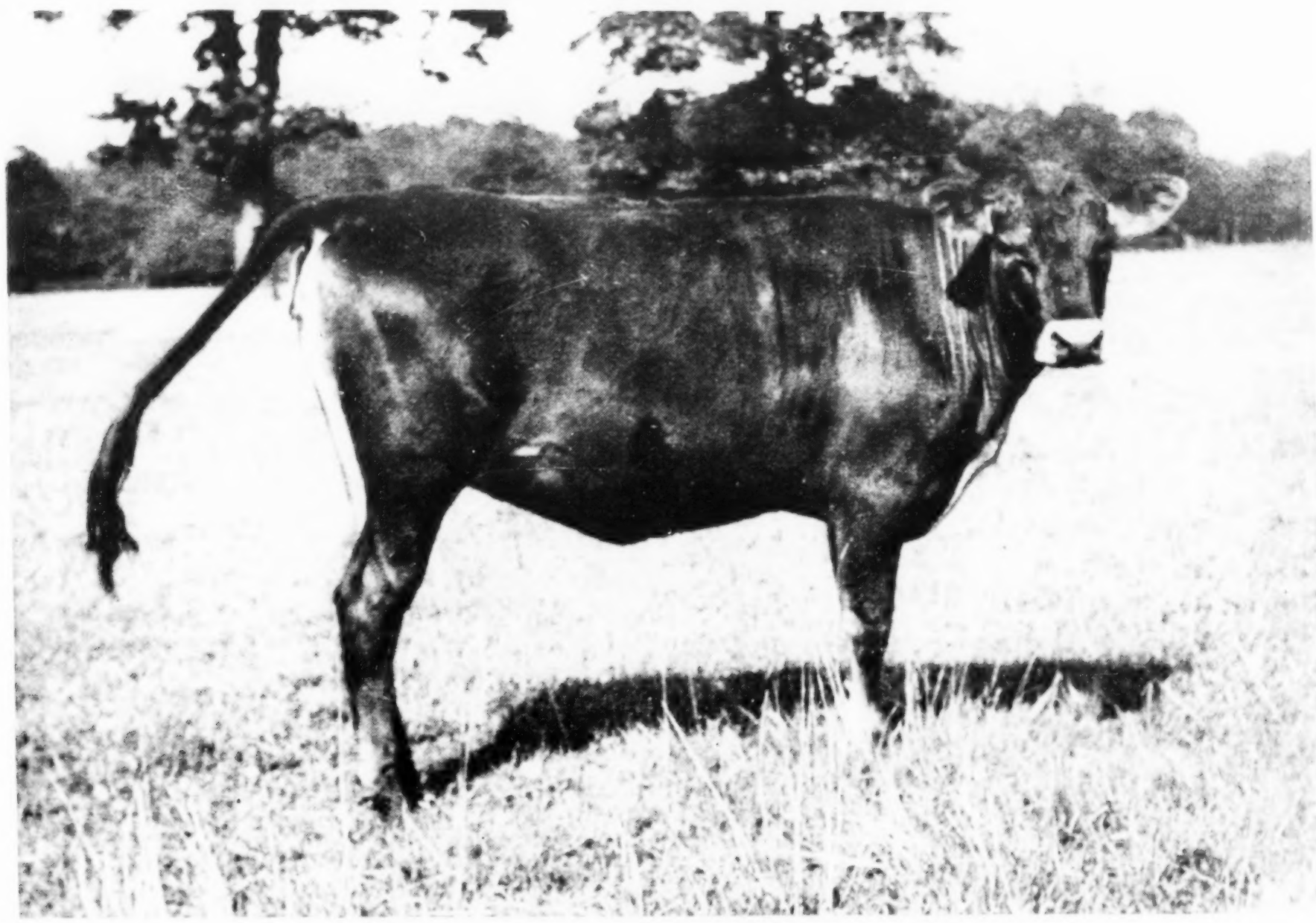
THE SIRE OF THE HYBRID HERD

Second generation bull of the Jersey x Angus cross. He is reddish fawn, slightly brindled, with a Jersey muzzle. (Fig. 8.)



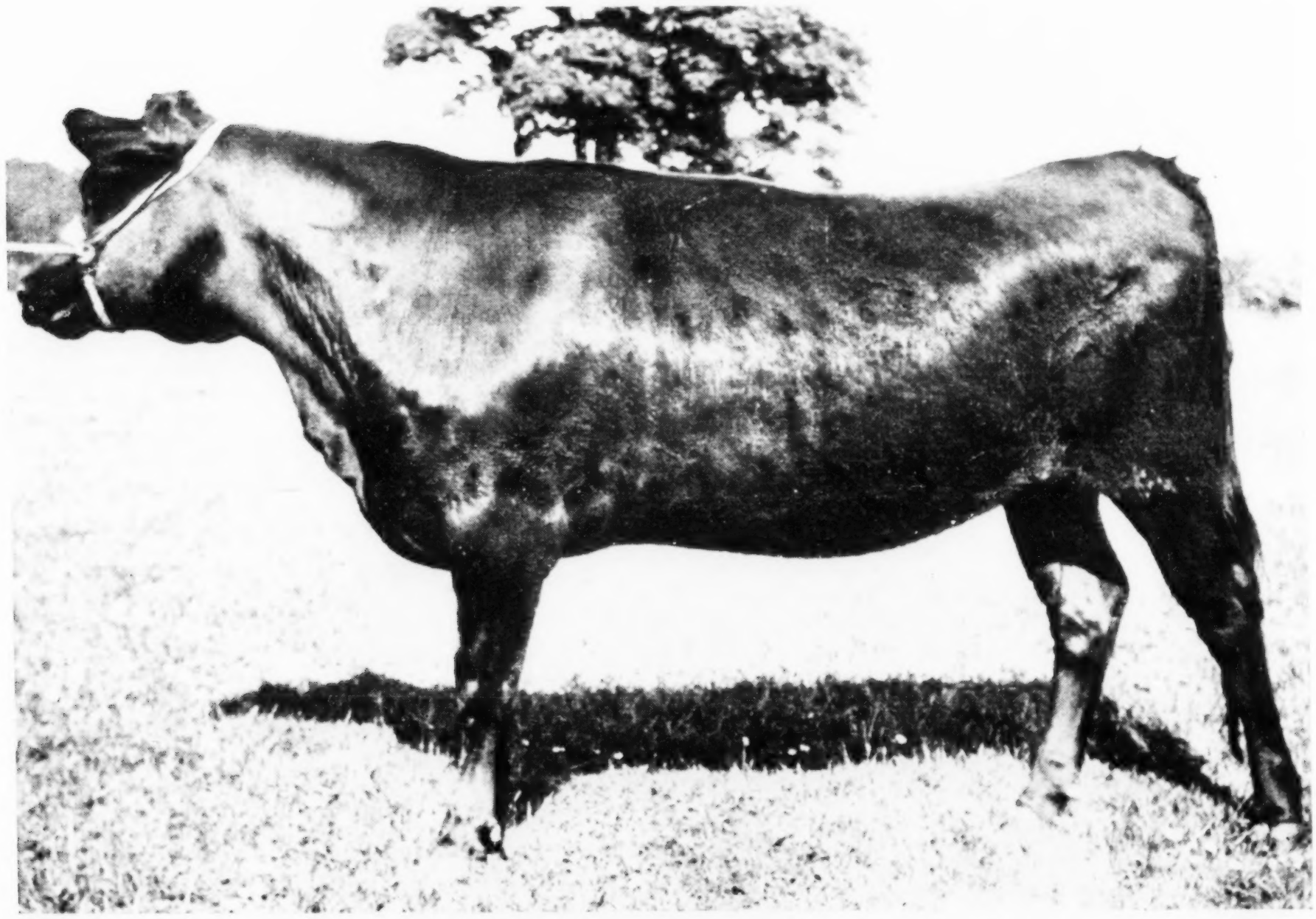
ALMOST A TYPICAL ANGUS

Another second generation bull from the Jersey x Angus cross, who shows very few of the Jersey characteristics. Not being of the type desired by the breeder, he has been discarded in favor of one who shows fewer of the Angus traits. (Fig. 9.)



SECOND GENERATION HEIFER

One of the favorites in the herd. She has a light muzzle and inner thighs, while body is dark fawn. (Fig. 10.)



SECOND GENERATION HEIFER

Rather too smooth and beefy to meet the breeder's tastes. He is seeking a dairy strain first of all, and although he wants it to have beef qualities, he does not care to let the latter preponderate. (Fig. 11.)

fawn and slightly brindled and has a typical Jersey muzzle. He seems to be more red than any of the cross-breds obtained thus far. His poll is slightly rounded and while he is not hornless the scurs are very short and loose. The other F_2 bull (Fig. 9), is polled, jet black and could almost pass as an Angus. The owner does not favor this type and will hold him in reserve to be used in the herd only if it should become necessary.

While the F_1 generation shows much uniformity, the F_2 individuals show marked variations in conformation and color indicating a segregation and recombination of the characters of the original parents. This fact always needs consideration by one who is trying to develop a new breed. The following are some of the apparent types which have appeared in the second generation of this Jersey-Angus cross:

Black polled "Angus" type;
Black horned;
Black with indication of fawn, "Jersey" type;
Black and white, horned;
Orange fawn with light muzzle and polled;
Brindled fawn with dark muzzle;
Black with grey hairs in face.

Only those animals that are of the type that Mr. Samuelson likes are kept for breeding purposes. He prefers a dun or red fawn to a black color and does not like those that are too "beefy." He is working on this as a commercial proposition, but is keeping an accurate record of every animal, its performance and final disposition. Those cross-breds that are not used in the breeding herd are sold in the open market as Jersey-Angus crosses, and bring prices as good as most beef cattle. A pair of yearling heifers brought $62 each, while the average price of a dozen or more hand-reared, two-year-old fat steers is about $92.50. There was little or no discrimination against them on account of the Jersey blood they carried.

The two F_3 calves were born since I saw the herd but according to information received from the estate they are very dark. Six more F_3 calves are expected this winter, and the heifers of this cross will be mated with an F_3 bull.

It is the owner's intention to continue this work and perhaps establish a new breed. Of course this will necessarily require a long time and the discarding of many animals that do not come up to the standard.

This herd was particularly interesting to me for the same cross was begun by Leon J. Cole of the Department of Experimental Breeding of the University of Wisconsin in 1912, but without knowledge at the time of this practical trial which was started several years earlier. In the Wisconsin experiment Jersey cows are mated with an Angus bull and Angus cows with a Jersey bull. The object is to study the segregation and behavior of the characters of these two breeds, which differ so markedly in conformation, type and function. Thus far only the first cross, consisting of seven F_1 offspring, has been obtained and as might be expected they are similar to those obtained from the same cross in England. By means of measurements and analyses it is hoped to secure information on the number, nature and method of transmission of many of the characters of the two breeds.

Genealogy and Eugenics

An International Congress of Genealogy will assemble at San Francisco during the week beginning Monday, July 26, under the management of the California Genealogical Society. All genealogical, historical, patriotic and family societies and associations throughout the world are invited to appoint delegates. Among the subjects for consideration is the relation between genealogical investigation and eugenics. Miss Carlie Inez Tomlinson, Exposition Building, San Francisco, is secretary of the committee on organization.

TOBACCO MUTATIONS

Sports of Great Value Apparently Not Due to Hybridization But to Some Change in the Reproductive Cells After Fertilization—History of the Mutants.[1]

H. K. HAYES

Associate Professor of Plant Breeding, College of Agriculture, University of Minnesota, St. Paul, Minn.

SOME one has said that inheritance is the ability to produce certain characters under certain favorable conditions of environment. As some plants have slightly more favorable conditions than others, even when all are grown under fairly uniform environment, we find that there are always some plants in which the character under observation is more fully developed than in others. Permanent improvement in plants by the selection of these fluctuations has not, however, generally been obtained, and when this method has given new types the results can, as a rule, be more logically explained as due to the isolation of the better biotypes of the race than by the gradual production of a new character by continuous selection. The ability of a breeder to produce new types is therefore dependent on the possibility of obtaining new inheritable variations.

We now know that variation can be produced by crossing. If we cross two biotypes which differ by certain characters, an increase in variability is obtained in the second generation after the cross. The selection in this generation of those plants which most nearly approach the desired habit, and further pedigreed breeding until the races breed true for the desired characters, have produced many new plant varieties of economic importance.

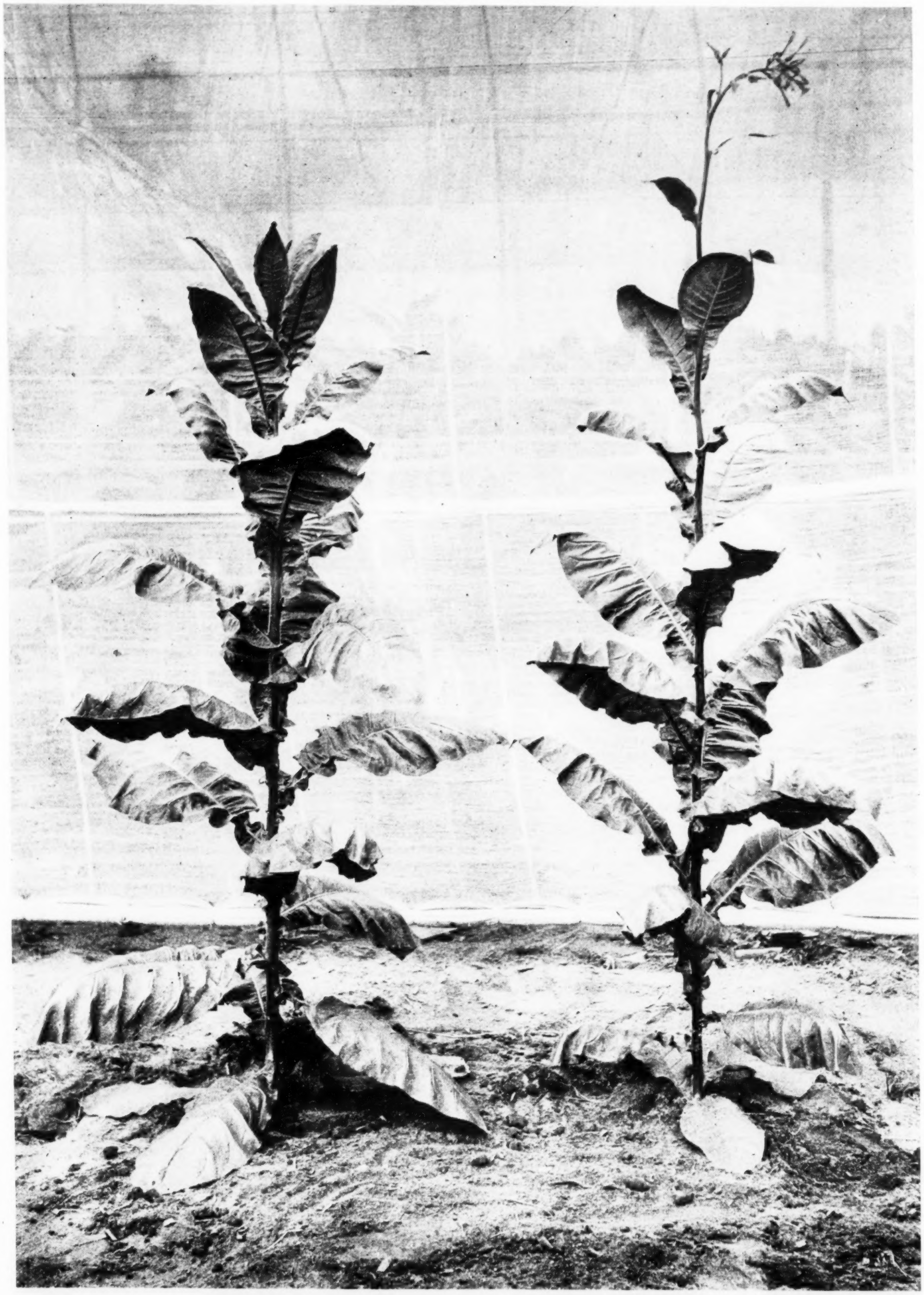
New types in supposedly homozygous material, which suddenly appear and cannot be explained by crossing, are known as mutations. It is the purpose of this paper to describe a constantly recurring mutation in Connecticut Havana tobacco and to give further notes in regard to the sport which appeared in 1912 in a field of Connecticut Cuban shade tobacco.

SHADE TOBACCO IN CONNECTICUT.

The history of the production of the Connecticut Cuban shade type is well known. It was first grown in this country in 1904 from seed which was brought from Cuba the previous year by William Hazelwood, of New York City. The first few crops were variable in habit, but selection soon served to isolate numerous biotypes. One line known as 13-29 proved its superiority. Seed from a number of self-fertilized plants of this line was saved in 1908 and was used for planting in 1910 at the Windsor Tobacco Growers' Corporation in Bloomfield, giving a crop of uniform appearance in which no variations of importance were noticed. A large number of seed plants of this crop were saved, although the individual seedheads were not separately covered with a manila paper bag to prevent crossing, as was the plan from 1904 to 1909. It does not seem very likely, however, that much crossing would take place under the cheesecloth cover, and even if some crossing took place it would be between homozygous individuals. Thus, prior to 1910 the Cuban variety was selfed for six generations and gave every evidence that it was of a homozygous nature.

Further evidence that this Cuban strain was homozygous for leaf number may be given by the following experiment. In 1910, 150 plants grown from

[1] This Study was made at the Connecticut Experiment Station in New Haven.



THE MUTANT AND ITS PARENT

At the left, a "Stewart Cuban" plant, at the right a plant of the normal Cuban tobacco from which the former originated suddenly in 1909. Photograph taken August 1, 1913: the normal type has already produced a blossom, while the mutant flowers very much later. The greater leaf yield of the mutant will also be noticed. (Fig. 12.)

the 1908 Cuban seed were carefully counted for leaf number, the method being to count the leaves on the main stem beginning at the fourth leaf from the base and counting to the leaf below the bald sucker at the top, the bald sucker being the first sucker which does not produce true leaves. This method gives approximately the number of leaves which are usually harvested. In 1910 the plant which had the largest leaf number was self-pollinated by covering the seed-head with a manila paper bag. This method of selection for high leaf number has been continued from 1910 to 1914, inclusive, each year a plant with high leaf number being selected as a parent for the following generation. The total variation for leaf number was from 14 to 25 leaves per plant. The mean for 1910 was 19.9 leaves per plant, and in 1914 a mean of 19.9 leaves was also obtained. A total of 832 plants was counted, the smallest number of plants grown in any generation being 124 and the largest number 210. The experiment has therefore given negative results and serves to illustrate the impossibility in this variety of increasing the average leaf number by the continuous selection of fluctuations.

NEW TYPE INCREASED.

In 1912 the Windsor Tobacco Growers' Corporation grew about 100 acres of shade tobacco from seed saved under the cheesecloth cover in 1910. The general appearance of the crop was uniform, and until late in the season no variations of importance were noted. During the clearing of the field by cutting down the stalks, one plant after being cut was observed to have a large number of unpicked leaves and no blossom. This plant was brought to the attention of the plantation manager, J. B. Stewart, who, after systematic search, found two others of similar habit. One of these, on being transplanted and taken to the greenhouse of the Connecticut Agricultural Experiment Station in New Haven, survived and bore 72 leaves on the main stem, blossoming about January first. Considerable seed was saved from this plant.

In 1913 about one-third of an acre of this new type was grown at the Windsor Tobacco Corporation's plantation. The plants were of uniform appearance and differed from the normal Cuban in having leaves of a somewhat lighter green shade, in a partial absence of basal suckers, and in a practically indeterminate growth, whereas the normal Cuban variety bears a terminal inflorescence after producing from 14 to 25 leaves on the main stem. Twenty plants were taken to the Connecticut Experiment Station greenhouse in the fall of 1913. These commenced to blossom about the first of November, the range of leaf counts being from 62 to 80 leaves per plant.

About 25 acres of the new type, which has been called the "Stewart Cuban," have been grown in the valley this last season, and all bred true to the new habit of growth.

The third of an acre of Stewart Cuban which was grown at the Windsor Tobacco Corporation's plantation in 1913 was fermented, assorted, and compared with the Hazelwood Cuban type. The quality of leaf seemed as good as that of the normal type, and an increased yield per acre of approximately 90% was obtained. The value of the 1914 crop will also be determined. As the final determination of the value of a new type of tobacco depends on its conformity to the trade ideals, it is too soon to make any definite statements about the value of this new type.

In order to obtain seed of the Stewart Cuban it is necessary to transplant a few plants to the greenhouse and thus prolong their period of growth. Plants thus transplanted blossomed about November first, producing an average of 70 leaves on the main stem. As the tobacco seed-beds are generally started about the first of April, it was thought that sowing seed in the greenhouse the last of December and growing the plants in pots until the last of May and then transplanting them out of doors would give them sufficient start so that they would blossom before frost in the Fall. Accordingly, on December 28, 1913, some seed of the Stewart Cuban was sown in sterilized

AFTER THE SECOND PICKING

Stewart Cuban shade grown tobacco at Windsor, Conn., August 18, 1913. These plants have produced more than 30 leaves to the stalk, and two pickings have already been made. As the lower leaves ripen sooner than the upper ones do, they are harvested first, and five or six pickings are required to get the entire crop at the right stage. (Fig. 13.)

soil in the greenhouse of the Connecticut Agricultural Experiment Station, the plants being transplanted when necessary, 8-inch pots bei g finally used. About the last of May, the plants were set out in the garden at the Connecticut Agricultural Station grounds in New Haven. They grew luxuriantly during the season, and about the middle of September they were photographed and examined. At this time they were from 12 to 14 feet tall, had produced an average of 80 leaves to the plant, and none showed signs of a blossom. On transplanting these to the greenhouse, however, only a few more leaves were

produced and all plants blossomed early in October. It seems very likely that a change in conditions may cause the plants to blossom.

OTHER MUTANTS FOUND.

The normal Cuban seed which was saved in 1910 was again used for planting in 1913 and 1914, and over 350 acres, or two and a half million plants, were grown. Although search was made at the Windsor Tobacco Growers' Corporation, which grows over 200 acres, no mutating plants were found. Several plants were, however, reported from other plantations where the 1910 Windsor Tobacco Corporation seed was used, which presented the same habit of producing a large leaf number. As all plants of this new type came from the same seed, it can not be stated that they did not come from a single normal plant.

Mutations of high leaf number have been observed in tobacco previous to this time. Several years ago a variant with a large leaf number was found in the outdoor Havana type at the farm of Mr. Alsop in Avon, and in 1912 two Havana plants which bore a large number of leaves were found at the Olds Brothers' plantation in Bloomfield. One other similar plant was found by another Bloomfield farmer.

The Olds Brothers' Havana sport found in 1912 has now been tested, about five hundred plants of this type being grown in 1914. All bred true and none showed signs of a blossom during the normal growing season.

It is of interest that these mutations have occurred in a variety, the Connecticut Havana, which has been grown in Connecticut for a period of over 50 years and which is of uniform habit. That it has been observed in different sections and by different growers shows that the same mutation must have taken place several times. In all of the above examples the mutation has only appeared for a single generation.

Recently, however, we have learned of a constantly recurring mutation for large leaf number which has been observed and studied by L. A. Clapp, a tobacco farmer of Windsor. Mr. Clapp grew 24 acres of Connecticut Havana in 1912 from seed which he saved in 1911 from normal Havana plants. The Havana, as is the case with Cuban, produces from 14 to 25 leaves on the main stem before blossoming. During the work of harvesting his crop by the priming method,[2] Mr. Clapp observed six plants which had not produced a blossom and which bore a large number of unpicked leaves. Thirty-six leaves from one of these plants were harvested, strung on a single lath and, after being cured, were examined by a tobacco buyer, who was very much pleased with their quality.

This interested Mr. Clapp, who examined his 24 acre field in 1913, which he grew from seed saved from normal plants of his 1912 crop. After careful search, a dozen plants of the many-leaved type were found. One of these was transplanted and taken to a greenhouse. It blossomed during the winter and some seed was obtained. Mr. Clapp grew about 500 plants of this type in 1914 and all bred true to the new habit.

24 acres of the normal Havana were grown in 1914 from seed saved from normal 1913 plants and, while no careful counts were made, Mr. Clapp observed about 50 plants of the many-leaved type.

These mutations can hardly be explained as the result of accidental crosses. A large series of crosses have been made in Connecticut, and, as a rule, there has been some increase of variability for leaf number in the second hybrid generation. In no case have we obtained types which exhibit this pe-

[2] The "priming method" of harvesting a tobacco crop is a recognition of the fact that the lower leaves of a plant ripen before the upper leaves. In it, four or five pickings are usually made: at the first one three or four leaves are taken, at the second five to seven, the same number at the third picking, and all remaining leaves at the fourth picking, when only four are made. The method was introduced into Connecticut with the culture of tobacco under cheesecloth cover, and the entire crop (over 2,000 acres) of tobacco grown under cover in the Connecticut valley is harvested by priming; most of the tobacco grown outdoors is still harvested by the old method of cutting the entire plant close to the ground.

culiarity of a practically indeterminate growth.

DeVries recognized two types of mutation: (1), a germinal change in either the male or female reproductive cell before fertilization, in which case the mutating individual was a first generation hybrid and did not breed true; and (2), a mutation after the union of the male and female reproductive cells. He chiefly emphasized mutations belonging to this second class as they bred true and could therefore be distinguished from variations due to hybridization. These tobacco mutations seem to belong to the class in which a change has taken place after fertilization. DeVries also believed in periods of mutation. From this standpoint the constantly recurring variation in the Connecticut Havana variety is of some interest.

NEW PUBLICATIONS

EINFÜHRUNG IN DIE EXPERIMENTELLE VEREBUNGSLEHRE, von Prof. Dr. phil. et med. Erwin Baur. 2. neubearbeitete Auflage mit 131 Textfiguren und 10 farbigen Tafeln. Verlag von Gebrüder Borntraeger, Berlin W. 35, 1914. Pp. 401, 14 mk., 50 pfg.

Dr. Baur's Introduction to Genetics, which was published in 1911, has been reissued after complete revision which brings it up to date. It covers much the same ground as the text-books of Plate and Goldschmidt; one must regret that no English genetist has yet produced a text-book on similar lines. Although intended primarily for students, Baur's work will be of interest to every genetist, because of the extent to which he has drawn on his own researches for illustrative material. The book, as its title promises, confines itself as nearly as possible to experimental data, admitting only as much theoretical discussion as seems absolutely necessary; the cytological section has also been reduced to a minimum. The illustrations are particularly good. A bibliography of 30 pages will be welcomed by many.

THE FUNDAMENTALS OF PLANT BREEDING, by John M. Coulter. Pp. xiv+346, 109 figures, price $1.50. New York and Chicago, D. Appleton and Company, 1914.

Dr. Coulter, head of the department of botany of the University of Chicago, has written this book for "those who wish a simple statement of evolution and heredity; who wish information concerning the revolution in plant breeding; or who wish a general introduction to the fundamental principles underlying agriculture. This should include citizens interested in the things that make for the public welfare, farmers, students of agriculture, teachers in the public schools, and botanists." People belonging to these classes will find it useful and satisfactory; it tells the story of the application of genetics to horticulture and agriculture in a comprehensive, although necessarily general way, and does so understandably. These qualities are certain to secure it a wide welcome. The typography and illustrations, however, are not worthy of the book.

Restrictions of Marriage

There may be some who think the English would be happier if their marriages were arranged at Westminster, instead of, as hitherto, in Heaven. I am not of that opinion, nor can I suppose that the constructive proposals even of the less-advanced eugenists would be seriously supported by any one who realized how slender is our present knowledge of the details of the genetic processes in their application to man. Before science can claim to have any positive guidance to offer, numbers of untouched problems must be solved. As regards practical interference there is nevertheless one perfectly clear line of action which we may be agreed to take—the segregation of the hopelessly unfit.—William Bateson. Biological Fact and the Structure of Society (1912).

THE PEOPLING OF AMERICA

Aborigines Represent the Yellow-brown Race of Asia and Polynesia—Arrived on This Continent in Relatively Recent Period—Characteristics of the Stock.[1]

DR. ALES HRDLICKA,
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FOR the American anthropologist no subject is of more interest than that of the racial affinity and the place or places of origin of the American aborigines. Ever since the discovery of the new continent and its peoples these questions have occupied many minds, but have not as yet been brought to the point of final answer. Numerous opinions were advanced, but they were almost wholly the results of speculation, fettered on one side by lack of scientific research and on the other by various traditions.

When Columbus discovered the New World he and his companions imagined, as is well known, that they had reached the Indies, and the people met were naturally taken for natives of those regions. Later, as the true nature of the new land became better known, speculation concerning the newly discovered race took other directions, and some of the notions developed proved disastrous to the Indians. History tells us that many of the early Spaniards, up to Las Casas' time, reached the conclusion that, as no mention was made concerning the American people in Hebrew traditions, they could not strictly be regarded as men equivalent to those named in biblical accounts, and this view, before being counteracted, led directly or indirectly to much enslavement and destruction of the native Americans.

Later, the origin of the Indians was sought in other parts of the world, and the seeming necessity of harmonizing this origin with biblical knowledge led to many curious opinions.[2] One of these, held by Gomara, Lerius, and Lescarbot, was to the effect that the American aborigines were the descendants of the Canaanites who were expelled from their original abode by Joshua; another, held especially by McIntosh,[3] that they were descended from Asiatics who themselves originated from Magog, the second son of Japhet; but the most widespread theory, and one, the remnant of which we meet to this day, was that the American Indians represented the so-called Lost Tribes of Israel.[4]

MORE RATIONAL IDEAS.

During the course of the nineteenth century, with Levegue, Humboldt,[5] McCullogh,[6] Morton,[7] and especially Quatrefages,[8] we begin to encounter more rational hypotheses concerning the Indians, although by no means a single opinion. Lord Kaimes, Morton,

[1] Extract from the proceedings of the Eighteenth International Congress of Americanists. The photographs of Asiatic types were furnished by Dr. Hrdlicka, the photographs of American types by the Smithsonian Institution, Bureau of American Ethnology.

[2] See Garcia Clavigero and the older American historians.

[3] McIntosh, J. "Origin of the North American Indians," New York, 1843.

[4] Adair, J., "History of the North American Indians," London, 1775.

[5] Humboldt, "Political Essay," I, p. 115; Humboldt and Bonpland, "Voyage, Vues des Cordillères," Paris, 1810.

[6] McCullogh, "Researches, Philosophical and Antiquarian, Concerning the Aboriginal History of America," Baltimore, 1829.

[7] Morton, S. G., "Distinctive Characteristics of the Aboriginal Race of America," 2nd ed., pp. 35-36, Philadelphia, 1844. (Also his "Crania Americana" and "Origin of the Human Species.")

[8] Quatrefages, "Histoire générale des races humaines," Paris, 1887.

MONGOLIAN WOMAN AT URGA

If dressed in the clothes of the American Indian she could not be distinguished from a native of the New World, according to Dr. Hrdlicka. Urga is the capital of Outer Mongolia. (Fig. 14.)

PAWNEE GIRL FROM CENTRAL UNITED STATES

The slight upward slant of the eye-slit, and the characteristic conformation of the upper lid at the inner corner of the eye, both usually supposed to be characteristic of the Mongolians, are in reality equally common among the American Indians. The "white of the eye" is yellowish, again as in the Mongolian race. (Fig. 15.)

and Nott and Gliddon[9] professed the belief that the American natives originated in the new world and hence were truly autochthonous; Grotius believed that Yucatan had been peopled by early Christian Ethiopians; according to Mitchell the ancestors of the Indians came to this country partly from the Pacific Ocean and partly from north-eastern Asia; the erudite Dr. McCullogh believed that the Indians originated from parts of different peoples who reached America over lost land from the west "when the surface of the earth allowed a free transit for quadrupeds." Quatrefages viewed the Americans as a conglomerate people, resulting from the fossil race of Lagoa Santa, the race of Parana, and probably others in addition to which he believed there had been settlements of Polynesians; and Pickering thought that the Indians originated partly from the Mongolian and partly from the Malay.

The majority of the authors of the last century, however, including Humboldt, Brerewood, Bell, Swinton, Jefferson, Latham, Quatrefages, and Peschel,[10] inclined to the belief that all the American natives, excepting the Eskimo, were of one and the same race and that they were the descendants of immigrants from North-eastern Asia, particularly of the "Tartars" or Mongolians.

The most recent writers, with one marked exception, agree entirely that this country was peopled through immigration and local multiplication of people; but the locality, nature, and time of the immigration are still much mooted questions. Some authors incline to the exclusively north-eastern Asiatic origin; others, such as Ten Kate and Rivet, show a tendency to follow Quatrefages in attributing at least some parts of the native American population to the Polynesians; Brinton[11] held that they came in ancient times over a land connection from Europe; and Kollmann,[12] basing his belief on some small crania, believes that a dwarf race preceded the Indian in America.

AMEGHINO'S HYPOTHESIS.

A remarkable hypothesis concerning the origin of the American native population, deserving a few words apart, has within the last 30 years, and especially since the beginning of this century, been built up by Ameghino,[13] the South American paleontologist. This hypothesis is, in brief, that man—not merely the American race, but mankind—originated in South America; that the early man became differentiated in the southern continent into a number of species, most of which eventually became extinct; that from South America his ancestors migrated over ancient land connections to Africa, and from there peopled, in the form of *Homo ater*, the larger parts of the African continent and Oceania; that a strain multiplied and spread over South America, and somewhere in the second half of the Pliocene migrated to North America and that from North America man went to Asia and Europe, where he gave rise to the *Homo mongolicus* and *Homo caucasicus*.

In addition there have been some suggestions that the Americans may have arrived from the "lost Atlantis;" and the theory has even been expressed that man, instead of migrating from north-eastern Asia into America, may have moved in the opposite direction, and especially that, after peopling this continent, a part of the Americans reached Siberia.[14]

[9] Nott and Gliddon, "Types of Mankind, and Indigenous Races." (The latter includes statements by Leidy and Morton.)

[10] Peschel, O., "The Races of Man," p. 418, 1876.

[11] Brinton, D. G., "The American Race," New York, 1891.

[12] Kollmann, J., "Die Pygmäen" (Verh. d. Naturforsch, Ges. Basel, xvi, Basel, 1902).

[13] Ameghino, F., "El Tetraprothomo Argentinus" (Anal. Mus. Nac. xvi, Buenos Aires, 1907); also "Le Diprothomo platensis" (ibid., xix, 1909).

[14] In this connection see also Campbell, J., "Asiatic Tribes in North America," Proc. Canadian Inst., N. S., i, Toronto, 1881; Mason, O. T., "Migration and the Food Quest; a Study in the Peopling of America," Smithsonian Report for 1894, Washington, 1896, pp. 523-540; Morse, E. S., "Was Middle America Peopled from Asia?" Popular Sci. Mo., November, 1898; Powell, J. W., "Whence Came the American Indians?" Forum, February, 1898; "Major Powell's Inquiry, 'Whence Came the American Indian?' An Answer," by J. Wickersham, Tacoma, Washington

GILIAK WOMAN FROM ISLAND OF SAKHALIN

Many of the women of this part of Asia, "individually less modified by environment than the men, if introduced among the Indians and dressed to correspond, could by no means at the disposal of the anthropologist be distinguished apart," says Dr. Hrdlicka. (Fig. 16.)

YAKIMA INDIAN, SHAHAPTIAN STOCK

The habitat of this tribe is in the extreme northwest United States and British Columbia. The broad face, well developed chin and large mouth with slightly full lips are highly characteristic of the yellow-brown race, whether it be studied in Asia or America. (Fig. 17.)

The Eskimo have been generally considered as apart from the Indian, some holding that they preceded and others that they followed him. They have been connected generally with the north-eastern Asiatics, but there are also those who see a close original relation between the Eskimo and the Lapps, and even between the Eskimo and the Paleolithic Europeans.

These are, in brief, the various more or less speculative opinions that so far have been advanced in an effort to explain the ethnic identity and the place of origin of the American Indian; and it is only logical that the next word on these problems be given to physical anthropology, which deals with what are, on the whole, the least mutable parts of man, namely, his body and skeleton.

The somatology of the Indians, which barely saw its beginnings in the time of Humboldt and Morton, has now advanced to such a degree that at least some important generalizations concerning the American aborigines are possible. We have now at our disposal for comparison, in American museums alone, upwards of 20,000 Indian crania and skeletons from all parts of the continent, while several thousand similar specimens are contained in European collections. A considerable advance, particularly in North America, has also been made in studying the living natives. Unfortunately, we are much less advantageously situated in regard to comparative skeletal material as well as with respect to data on the living man from other parts of the world, particularly from those regions where other indications lead us to look for the origin of the Indian.

THE FACTS IN THE CASE.

What can be stated in the light of present knowledge concerning the American native with a fair degree of positiveness is that:

1. There is no acceptable evidence, nor any probability, that man originated on this continent;

2. Man did not reach America until after attaining a development superior to that of late Pleistocene man in Europe, and after having undergone advanced and thorough stem, and even racial and tribal, differentiation; and

3. While man, since the peopling of the American continent was commenced, has developed numerous secondary, sub-racial, localized structural modifications, these modifications cannot yet be regarded as fixed, and in no important features have they obliterated the old type and sub-types of the people.

We are further in a position to state that, notwithstanding the various secondary physical modifications referred to, the American natives, barring the more distantly related Eskimo, present throughout the Western Hemisphere numerous important features in common, which mark them plainly as parts of one stem of humanity. These features are:[15]

1. The color of the skin. The color of the Indian differs, according to localities, from dusky yellowish-white to that of solid chocolate, but the prevailing color is brown.

2. The hair of the Indian, as a rule, is black, medium coarse and straight; the beard is scanty, especially on the sides of the face, and it is never long. There is no hair on the body except in the axillae and on the pubis, and even there it is usually sparse.

3. The Indian is generally free from characteristic odor. His heart-beat is slow. His mental characteristics are everywhere much alike. The size of the head and of the brain cavity is comparable throughout, averaging somewhat less than that of white men and women of similar stature.

4. The eyes, as a rule, are dark brown in color, with dirty yellowish conjunctiva in adults, and the eye-slits show a prevailing tendency, more or less

1899, pp. 1-28; Hallock, Charles, "The Ancestors of the American Indigenes," Amer. Antiquarian, xxiv, No. 1, 1902, and the publications of the Jesup Expedition of the American Museum of Natural History, New York.

[15] The remarks apply to the Indian not affected by sedentary habits and other conditions due to changed mode of life attending the process of civilization.

A YOUNG MANCHU

He would pass without the slightest difficulty for an Indian student at Haskell or Carlisle, Dr. Hrdlicka remarks. The nose is characteristic of the stock on both sides of the Pacific, being mesorhinic or moderately broad—not flat like that of a negro nor again thin like that of a Caucasian. (Fig. 18.)

PIMA INDIAN FROM ARIZONA

With the headdress peculiar to some of his tribe, he would easily pass for an oriental. As Dr. Hrdlicka notes, the American Indian resembles the Polynesian quite as strongly as he often does the "Tartar" or Mongolian. In many of the Mexican tribes the resemblance is still more striking. (Fig. 19.)

noticeable in different tribes, to a slight upward slant, that is, the external canthi are frequently more or less higher than the internal.

5. The nasal bridge is moderately to well developed, and the nose in the living, as well as the nasal aperture in the skull (barring individual and some localized exceptions), show medium or mesorhinic relative proportions. The malar regions are, as a rule, rather large or prominent.

TEETH ARE CHARACTERISTIC.

6. The mouth is generally fairly large, the lips average from medium to slightly fuller than in whites, and the lower facial region shows throughout a medium degree of prognathism, standing, like the relative proportions of the nose, about midway between those in the whites and those characteristic of the negroes. The chin is well developed, not seldom square. The teeth are of medium size when compared with those of primitive man in general, but perceptibly larger when contrasted with those of the cultured white American or European; the upper incisors of the Indian present an especially important feature; they are characteristically shovel-shaped, that is, deeply and peculiarly concave on the buccal side. The ears are rather large.

7. The neck, as a rule, is of only moderate length, and in health is never thin; the chest is somewhat deeper than in average whites; the breasts of the women are of medium size, and generally more or less conical in form. There is a complete absence of steatopygy; the lower limbs are less shapely and especially less full than in whites; the calf in the majority is small.

8. The hands and feet, as a rule, are of relatively moderate or even of small dimensions, and what is among the most important features distinguishing the Indian, the relative proportions of his forearms to arms and those of the distal parts of the lower limbs to the proximal (or, in the skeleton, the radio-humeral and tibio-femoral indices) are in general, throughout the two parts of the continent, of much the same average value, which value differs from that of both the whites and the negroes, standing again in an intermediary position.

This list of characteristics, which are, broadly speaking, shared by all American natives, could readily be extended, but the common features mentioned ought to be sufficient to make clear the fundamental unity of the Indians.

The question that necessarily follows is: "Which, among the different peoples of the globe, does the Indian as here characterized most resemble?" The answer, notwithstanding our imperfect knowledge, can be given quite conclusively. There is a great stem of humanity which embraces people ranging from yellowish-white to dark brown in color, with straight black hair, scanty beard, hairless body, brown, often more or less slanting eye, prevalently mesorhinic nose, medium alveolar prognathism, and in many other essential features much like the American native; and this stem, embracing several sub-types and many nationalities and tribes, occupies the eastern half of the Asiatic continent and a large part of Polynesia.

CLOSE RELATIONSHIP.

From the physical anthropologist's point of view everything indicates that the origin of the American Indian is to be sought among the yellowish-brown peoples mentioned. There are no two large branches of humanity on the globe that show closer fundamental physical relations.

But difficulties arise when we endeavor to assign the origin of the Indian to some particular branch of the yellowish-brown population. We find that he stands quite as closely related to some of the Malaysian peoples as to a part of the Tibetans, or some of the north-eastern Asiatics. It is doubtless this fact that accounts for the hypotheses that attribute the derivation of the American Indians partly to the "Tartars" and partly to the Polynesians.

All that may be said on this occasion is that the circumstances point strongly to a coming, not strictly a migration, after the glacial period, and over land, ice, water, or by all these media combined, from north-eastern Asia, of

PROFILE OF YOUNG MANCHU

The same individual was shown full face in fig. 18. Compare his alveolar prognathism with that of the American Indian in the next cut. The ear, it will be noted, is rather large,—a racial characteristic of the Indian, also. The hair, coarse, black, and straight, is precisely like that of the American Indian. (Fig. 20.)

A PUGET SOUND INDIAN

Skitswish tribe, Salisham stock. He illustrates the characteristic alveolar prognathism of the Indian—the slight projection of the teeth, altering the profile. The white race rarely shows this projection in such a degree, while in the negro race it is still more pronounced. (Fig. 21.)

relatively small parties, overflows of the far eastern populations of that time, and to the peopling of America by the local multiplication of man thus introduced, to comings repeated probably nearly to the beginning of the historic period.

As to Polynesian migrations within the Pacific, such were, so far as can be determined, all relatively recent, having taken place when America doubtless had already a large population and had developed several native cultures. It is, however, probable that after spreading over the islands, small parties of Polynesians have accidentally reached America. If so, they may have modified in some respects the native culture; but physically, being radically like the people who received them (barring their probably more recent negro mixture), they would readily blend with the Indian and their progeny could not be distinguished. In a similar way small parties of whites may have probably reached the continent in the east. They, too, may have introduced some cultural modifications, but they would necessarily consist of men only and of parties small in number, which would in the course of time blend thoroughly with the Indian.

The conclusions, therefore, are: the American natives represent in the main a single stem or strain of people, one homotype; this stem is identical with that of the yellow-brown races of Asia and Polynesia; and the main immigration of the Americans has taken place, in the main, at least, gradually and by the northwestern route in the earlier part of the recent period, after man had reached a relatively high stage of physical development and multiple secondary differentiations. The immigration, in all probability, was a dribbling and prolonged overflow, likely due to pressure from behind, or want, and a search for better hunting and fishing grounds in the direction where no resistance of man as yet existed. This was followed by multiplication, spread, and numerous minor differentiations of the people on the new, vast, and environmentally highly varied continent, by rapid differentiation of language due to isolation and other natural conditions, and by the development, on the basis of what was transported, of more or less localized American cultures. It is also probable that the western coast of America, within the last 2,000 years, was on more than one occasion reached by small parties of Polynesians, and that the eastern coast was similarly reached by small groups of whites, and that such parties may have locally influenced the culture of the Americans; but such accretions have nowhere, as far as we know today, modified the native population.

Genetics and Government

The great danger of democracy is that, more even than other forms of government, it may consider reforms too exclusively from the point of view of the immediate comfort of the individual, and may ignore the slow but irrevocable effect on the inborn character of future generations. All the more necessary is it that those who venture to assume the heavy responsibility of attempting to legislate for democracy should understand the nature of the fundamental problems of race on which the future welfare of the nation depends. The time may come when a genealogical survey of the families of a nation will be recognized to be of greater value than a geological survey of the country they occupy.—W. C. D. and C. D. Whetham: Heredity and Society.

Breeding for Energy

In any scheme of eugenics, energy is the most important quality to favor; it is, as we have seen, the basis of living action, and it is eminently transmissible by descent.—Francis Galton: Inquiries into Human Faculty (1907).

THE EARLY MARRIAGE QUESTION

"IT IS important," Galton remarked in 1883, "to obtain a just idea of the relative effects of early and late marriages." He attempted to do this in several ways, one of the most striking of which was that published in his "Inquiries into Human Faculty," and based on Duncan's statistics from a maternity hospital. Dividing the mothers into five-year groups, according to their age, and stating the medium age of the group, for the sake of simplicity, instead of giving the limits, he arrived at the following table:

Age of Mother at Her Marriage	Approximate Average Fertility
17	9.00—6 x 1.5
22	7.50—5 x 1.5
27	6.00—4 x 1.5
32	4.50—3 x 1.5

"which shows that the relative fertility of mothers married at the ages of 17, 22, 27 and 32 respectively is as 6, 5, 4 and 3 approximately.

"The increase in population by a habit of early marriages," he adds, "is further augmented by the greater rapidity with which the generations follow each other. By the joint effect of these two causes, a large effect is in time produced."

R. H. Johnson considered this phase of the question graphically in the JOURNAL OF HEREDITY for March, 1914. He said: "Suppose a generation to be 25 years or 33⅓ years respectively in two different stocks, and that all persons marry and each couple have four surviving children, or two for each parent. The result is that the 25-year stock constitutes two-thirds of the population at the end of a century."

By a combination of these two causes (to which might be added the lower death-rate claimed among the children of young parents), the result is, as Galton says, that "if the races best fitted to occupy the land are encouraged to marry early, they will breed down the others in a very few generations."

Something similar has happened in New England and many other regions, where a fertile foreign stock, marrying early, has nearly supplanted the earlier stock. The fact has frequently been a text for eugenic sermons.

But other eugenists have flatly denied the desirability of this sort of selective breeding, as applied to the human race. They have alleged that early childbearing had a bad physical effect on the mother, and both a bad physical and a bad mental effect on the offspring. The latter charge was made in an emphatic form by Casper L. Redfield of Chicago, as an answer[1] to Professor Johnson's article above cited. After quoting Johnson's illustration, he wrote:

ADVANTAGES CHALLENGED.

"The object of reproducing at the rate of four generations to the century is, of course, to produce superior individuals and increase the relative number of them in the entire population. Well, I will donate $100 to the treasury of the American Genetic Association if it can be shown that any superior individual was ever produced by breeding human beings as rapidly as four generations to the century. It is only necessary to find some superior individual from the intellectual standpoint whose date of birth is not more than 100 years after the average date of birth of his 16 great-great-grandparents. Any one of the 2000 or 3000 intellectually eminent men known to history, who comes in the four-generations-to-a-century class, will draw the $100.

"To make the matter interesting and easy, I will be satisfied to give the $100 if there can be found more than three

[1] Results of Early Marriage, by Casper L. Redfield. JOURNAL OF HEREDITY, V, 7, p. 316, July, 1914. Mr. Redfield's general position on the question of early marriage is set forth fully in his book "The Control of Heredity" (1903), and summarily in his more recent work "Dynamic Evolution" (New York and London, G. P. Putnam's Sons, 1914).

cases in which the intellectually superior person has as many as four generations in a century in the tail-male line alone."

Mr. Redfield then notes that much more than one-half of all people come within a three-generations-to-the-century class, taking the average age of male ancestors only, and continues:

"Now raising the standard of superior individuals to the exceptionally great men such as Aristotle, Augustus, Newton, Bacon, Faraday, Franklin, Humboldt, Cuvier, Darwin, etc., of whom there are some two or three hundred known to history, I will give a second $100 to the treasury of the American Genetic Association if a single one of them can be found in this three-generations-to-a-century class."

The time limit on both these offers was set at December 31, 1914. They were widely copied by newspapers throughout the United States, and a number of pedigrees sent in, but none of them conformed to the requirements. The most interesting letter in connection with the offer was sent directly to Mr. Redfield by J. B. Nicklin, Jr., of 516 Poplar street, Chattanooga, Tenn., who wrote:

"In reply to your offer in the *Hartford Times* I beg to submit the proven instances of five and six generations in less than a century:

1. Edward, Duke of Kent, born 1784.
2. Queen Victoria, born 1819.
3. Victoria, Empress of Germany, born 1840.
4. Wilhelm II, Emperor of Germany, born 1859.
5. Friedrich Wilhelm, Crown Prince, born 1882, making five generations in 98 years.

1. Maria Theresa, born 1717.
2. Leopold II, Emperor of Austria, born 1747.
3. Francis I, Emperor of Austria, born 1768.
4. Marie Louise, Empress of the French, born 1791.
5. Napoleon II, born 1811, making five generations in 94 years.

1. Josephine, Empress of the French, born 1763.
2. Eugene de Beauharnais, born 1781.
3. Josephine, Queen of Sweden, born 1807.
4. Carl XV, King of Sweden, born 1826.
5. Louise, Queen of Denmark, born 1851, making five generations in 88 years. Also four in 63 years.

1. Martha (Dandridge) Custis Washington, born 1732.
2. John Parke Custis, born 1755.
3. George Washington Parke Custis, born 1781.
4. Mary Anne Randolph (Custis) Lee, born 1807.
5. George Washington Custis Lee, born 1832 (son of Robert E. Lee), making five generations in exactly 100 years.

1. John Bailey Nicklin, born 1803.
2. Elizabeth Catharine (Nicklin) Connoly, born 1833.
3. Laura Nicklin (Connoly) Lee, born 1853.
4. Laura Florence (Lee) Dennison, born 1877.
5. Robert Lee Dennison, born 1901, making five generations in 98 years and in my own family.

1. Queen Victoria, born 1819.
2. Victoria, Empress of Germany, born 1840.
3. Wilhelm II, Emperor of Germany, born 1859.
4. Friedrich Wilhelm, Crown Prince of Germany, born 1882.
5. Eitel, his eldest son, born 1906, making five generations in 87 years.

1. Mary (Gregory) Taylor, born 1666.
2. Mary Bishop (Taylor) Pendelton, born 1688 (aunt of the President).
3. Philip Pendelton, born 1704 (her *second* son).
4. Mary (Pendelton) Waller, born 1722.
5. William Edmund Waller, born 1741.
6. Benjamin Waller, born 1762, making six generations in 96 years and proven by the Court Records in Virginia.

"I believe that these records, and I can send countless others should you desire them, will prove to you the fact that a century can and has produced four, five and six generations."

In reply to this letter Mr. Redfield wrote to Mr. Nicklin as follows:

"I have received your letter of December 10 and have forwarded it to the American Genetic Association, 511 Eleventh St., N. W., Washington, D. C. The money of my offer was deposited with the association some months since, and all decisions in the matter rest with them.

"I have not seen the notice in the *Hartford Times* and have not before heard of it. Consequently I do not know what the notice may contain, but I enclose a copy of my offer so that you may see exactly what it is.

"The persons you mention are

1. Friedrich Wilhelm, Crown Prince of Germany.
2. Napoleon II of France.
3. Louise, Queen of Denmark.
4. G. W. C. Lee, president of Washington and Lee University.
5. R. L. Dennison, born 1901.
6. Eitel, son of German Crown Prince.
7. W. L. E. Waller, born 1741.
8. Benjamin Waller, born 1762.

"The objections are:

"First, the persons named are not among 'the 2000 or 3000 intellectually eminent men known to history,' whose names are recorded in ordinary encyclopedias because of intellectual achievements. Not all royal personages noted in cyclopedias are there because of their intellectual superiority.

"Second, the pedigrees given are neither complete pedigrees, nor in the tail-male line for partial pedigrees.

"The generations of the offer are periods of time between parent and offspring. Except in the last case, you give four such periods, and consequently four generations instead of five as you represent it.

"Examples of breeding much more rapid than those you give are quite common, as among the 'Jukes' and other degenerate families of the United States; also in Asia, Africa and Polynesia. Marriages between boys less than 17 and girls less than 15 are the ordinary thing in many places. But the trouble with that kind of breeding is that it does not produce superior individuals. When we come to the greatest men, they are not produced when the breeding is as rapid as three generations to the century. My money offer was for the purpose of finding any possible exception, if it existed."

The only other reply of interest was from Mrs. Elizabeth A. Sourdry of 3404 Morgan street, St. Louis, Mo., who submitted the pedigrees of Wilhelm II, emperor of Germany, William Henry, fourth Duke of Portland, and Charles William Henry, fourth Duke of Buccleuch and sixth Duke of Queensberry. In each case three generations of the ancestry covered less than a century of time. Mrs. Sourdry sent copies of the genealogies directly to Mr. Redfield who in reply wrote her as follows:

"The first objection is that these men are mental mediocrities and not intellectual giants. William II is prominent because he inherited the position of emperor, but he has to his credit no intellectual achievements. If you are going into royalty I think that you should take such men as Augustus, Peter the Great or Gustavus Adolphus.

SOME GREAT MINDS.

"Consider Moses, who not only controlled an unruly mob but who formulated moral laws and regulations which are good after nearly 3,500 years.

"Consider Confucius, whose intellect produced the moral precepts which have guided hundreds of millions for more than 2,500 years.

"Consider Aristotle, who was the main scientific authority for the world for more than 1,000 years.

"Imagine a sickly little fellow sitting in Washington and changing this republic into a monarchy by the sheer force of his intellect. Imagine his influence with Congress being so great that the country would officially confer on him a title certifying the profound respect all entertained for his surpassing wisdom. That would be Augustus of Rome.

"A poor boy without the advantages of schooling became great as an author, great as an editor, great as an inventor, great as a diplomat and great as a statesman; he drew the lightning from the clouds and was honored by all of the scientific societies in the world. That was Benjamin Franklin.

"Humboldt was credited with being an authority in all known sciences. Darwin revolutionized the ideas of the world as to how the different kinds of plants and animals (including man) came into existence. Sitting in his study Leverrier could locate an unknown planet and give its size and orbit. Mendeleef formulated the periodic table and from it predicted the atomic weights and chemical properties of substance then unknown to science. J. J. Thomson has revolutionized our ideas of the constitution of matter.

"My offer related to this kind of men—men who were famous for intellectual power—the greatest intellects

in the world's history. It says intellectually eminent men. The majority of men are produced by breeding faster than three generations to the century, and it is easy to find mediocrities so produced. There are more than 50,000,000 of them in the United States. But can you find a real intellectual giant so produced? Are men like Copernicus, Newton, Faraday, Kant, Goethe, Shakespeare, Milton, Leibnitz, Lao-Tse, Buddha, Mohammed, Loyola, Luther, etc., produced by breeding as rapidly as three generations to the century? I think not.

"The offer in the tail-male line included three cases of four generations within a century. You give that only in the case of Buccleuch. The generations are $20+27+25+26=98$ years."

After considering the two letters, the council of the American Genetic Association decided that no one had submitted data fulfilling the requirements of the offer, and ordered Mr. Redfield's certified check for $200 to be returned to him.

PROF. JOHNSON'S POSITION.

Professor Johnson, whose advocacy of early marriage brought forth Mr. Redfield's challenge, has sent in the following note reiterating his position:

"Mr. Redfield is quite safe in holding that in illustrious stocks the generations are long. It is just this that I contend calls for remedy. To conclude from this, however, that late children are superior mentally is wholly unwarranted. Such late births will still be found to be prevalent with the superior, irrespective of whether late children shall be shown to be equal or superior to early children from the same parents. The reasons for these delayed marriages and births are now too familiar to call for repetition here.

"May I in turn suggest to Mr. Redfield a sound method of testing his hypothesis? Ascertain the number of brothers and the ordinal position among these of all the men in some standard collection of the names of illustrious men which will furnish the desired information. Sisters, owing to the different chance of becoming renowned, and half-brothers and stepbrothers are to be omitted. Compare the age of the parents at the birth of the most illustrious with the average age for his brothers in *each* family.

"But aside from this, even if Mr. Redfield's hypothesis prove correct, it is still true that inferior stocks are producing more early children as well as children in general than are the superior stocks. The mere lengthening of the generations of all stocks will not change the ill-balanced production of the next generation. It is necessary to increase the reproduction of the superior relative to the inferior, no matter to what other device resort may be made. Later marriage of the superior as compared with the inferior is therefore necessarily dysgenic."

Assuming for the sake of argument that the children of young parents are inferior, are they inferior because their parents are young, or are they inferior merely because they are first-born children? Readers will remember that the English Biometric school and other investigators have reached the latter conclusion; others have as strongly denied it. To settle this point, an investigation somewhat similar to the one suggested by Professor Johnson has been set on foot by the Italian Anthropological society.[2] When it is concluded, there should be some adequate ground for holding an opinion as to the superiority or inferiority of the first-born. In the meantime it should not be supposed that the failure of anyone to present such cases of genius produced by rapid breeding as called for by Mr. Redfield, settles the question of the influence of age of parent on quality of offspring. Though one of the most important questions in constructive eugenics, it is a question with many sides, and its solution has only been touched.

[2] Preliminary results of this investigation indicate that first-born sons are as good as their successors, if not better. See "Superiority of the Eldest," by Corrado Gini, in the JOURNAL OF HEREDITY, VI, 1, p. 37, January, 1915. The opposite view, with a brief review of the whole controversy, is given by John H. Chase, "Weakness of Eldest Sons," JOURNAL OF HEREDITY, V, 5, 209, May, 1914.

BREEDING FOR HORNS

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IN Birel we stopped with a farmer who had become a wealthy man through the sale of stag antlers, and saw how the women folks were boiling several magnificent pairs. They were all coated yet with the down, which is an absolute necessity to sell them, as the Chinese only take those which are young. This stagkeeping business has its headquarters in and around Birel and by pure accident we had stumbled upon one of the most interesting industries in this world.

It seems that about 40 years ago somebody in Birel made an experiment of keeping some stags in captivity and by sawing the antlers off and bandaging the wounds, showed that a stag can be de-antlered and survive the process and be operated upon every year. Up to that time the animals had been hunted until they were well-nigh extinct and the collecting of antlers was a very unsteady sort of a business, one never knew whether one would get much or not. Well, the animals multiplied and high-fenced enclosures were established all over the mountains, for these stags need much ground to pasture upon, otherwise they don't remain healthy. And today there are several thousand stags in and around Birel and the income derived from the sale of the antlers has made some people very wealthy, for every male animal produces about 70 Roubles[2] worth of antlers every year and some men have as many as 400 males. The average price paid for the antlers is between eight and 12 Rbls. per pound, according to the market.

The antlers are sawn off with a fine saw and weigh fresh twice as much as later on. They have to be boiled in salted water and very great care has to be taken that the felt-like covering doesn't come off; therefore they are boiled several times and each time allowed to dry out again. When sufficiently cooked, they are hung in the wind and allowed to dry thoroughly and in that state they are bought up by dealers and said to be exported to China via Mongolia. The Chinese, as you may know, believe thoroughly in the rejuvenating and stimulative power of young deer horns, and the stuff, scraped and powdered, forms a valuable ingredient in certain of their medicines. I was also told that a firm in St. Petersburg has taken up this matter and is manufacturing a special medicine from them, under the name of "Spermine."

[1] Extract from a letter to his chief, dated Omsk, Siberia, July 17, 1911.
[2] A rouble is worth about 51 cents, U. S. currency.

Corriedale Sheep in United States

F. R. Marshall of the Bureau of Animal Industry, U. S. Department of Agriculture, has returned from the antipodes with 10 rams and 54 ewes of the Corriedale breed, which are now in quarantine at San Francisco, and constitute the first importation of live stock ever made by the department of agriculture. With the exception of six head brought in last year, they are the first Corriedales to be brought to this country. The breed, which originated in the province of Canterbury, New Zealand, in the late seventies, and was long known officially as "inbred halfbreds," resulted from a Lincoln x Merino cross and in part from an English Leicester x Merino cross. It interests the stockman because it offers a combination of wool and mutton qualities, and the genetist because it appears to breed fairly true, in spite of the short time that has elapsed since its formation. In appearance it is very nearly a blend between the two parents, and there seems to be little segregation of characters in the breed at present.